

**Institutional Perspectives of
Agroecological Farming Systems
in Sri Lanka**

by

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Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any tertiary institution, and to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference is made in the text of the thesis.



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Abstract

Food security remains a crucial policy issue in developing countries as well as for the whole world. In recent times, subsistence farming systems based on indigenous agricultural practices have been gaining wider acceptance because of their significance for the livelihoods of the rural poor, and for the protection of the environment in developing countries. However, these systems have been largely disregarded on an institutional level. This study focuses on two types of subsistence agriculture in Sri Lanka that come under the category of agroecological farming systems namely, chena cultivation and Kandyan homegardens. The overarching purpose of this research was to understand how people in formal institutional structures perceived agroecological approaches to agriculture since their perspectives may have significant effects on policy formulation and implementation within the agriculture sector. It is expected that such understanding will contribute to scholarship in environmental management as well as policy development and application to ensure food security of the rural poor in Sri Lanka. This study drew on the qualitative research methodologies. One group of research participants were chosen from within district, division and village level institutional structures of the Sri Lankan government while another group was chosen from the Department of Agriculture and educational and research organizations at the national level. In meeting my research objectives I used two sets of questionnaires to collect data and hermeneutic and discourse analyses of participants' responses to distil meanings embedded in them.

I have presented my exploration of institutional perspectives under four sub-sections namely sustainable agriculture; agroecological production systems; chena cultivation and Kandyan homegardens; and institutional issues. The findings of the study drew attention to some salient views. In general ideas of environmental protection and meeting of human goals were central to the administrative officials' perspectives of sustainable agriculture. Their perceptions related to extension and training, participatory research and resource management revealed an openness towards community empowerment and power-sharing, endorsing a considerable degree of social equity in agricultural development. However, there is the belief that the impasse to sustainable agriculture outcomes is an unsupportive policy framework that favours a technology based, profit-oriented, agro-business model. On the other hand there is general consensus that traditional farming systems are appropriate models for achieving environmentally sound and socially

responsive agricultural outcomes specially for marginalized farming communities. Administrative officials attitudes towards chena cultivation in general ranged from ideas of approval to mixed impressions of its environmental soundness. The concept of stabilized chena cultivation appears to be open to debate and yet the lack of alternatives seems to suggest that what is required is a better understanding of the underlying factors that contribute to poor land management among present day chena cultivators. Kandyan homegardens on the other hand was acknowledged as having advantageous biological and ecological functions. Both farming systems were deemed as significant for survival of resources poor farmers. Despite the technocratic approach urged by the existing policy directives the attitudes of most administrative officials appear to embrace ideas that acknowledged social needs. In general an agroecological approach that coalesces traditional practices with scientific understanding leading to an agricultural paradigm that is suited to present day needs was viewed as an appropriate solution to the challenges facing Sri Lanka's agriculture sector.

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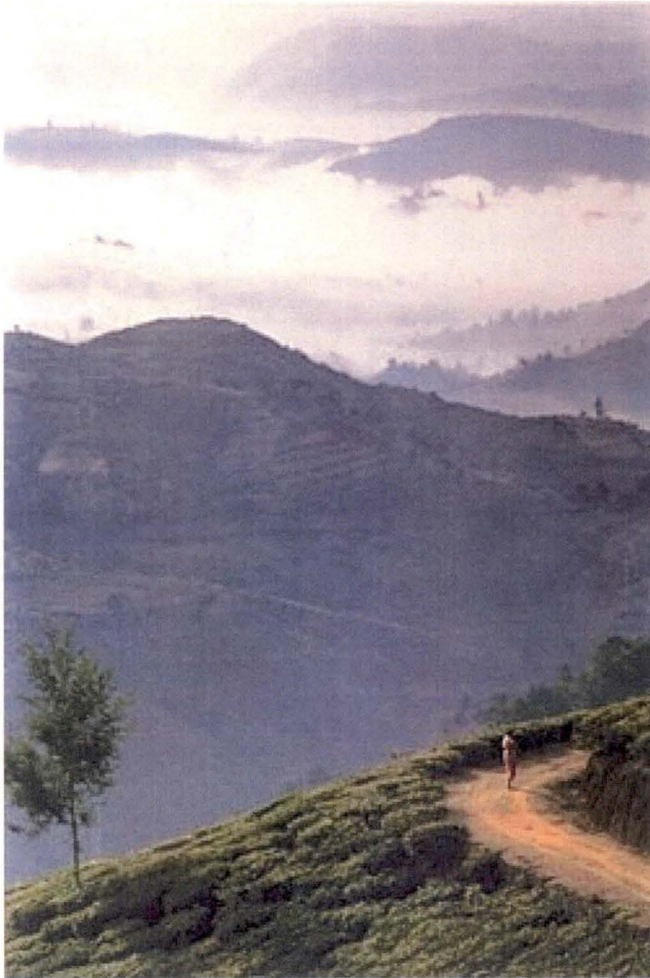
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Chapter 1

Introduction

Photo: Luke Powell, 1996



Photo: Dominic Sansoni, 2002

CHAPTER 1

Introduction

Aims and Objectives

The overarching purpose of this research is to understand how people in formal institutional settings perceive agroecological approaches to agriculture, since their perspectives may have significant effects on policy formulation and implementation in the agriculture sector. In turn, the development and application of policy may give effect to the capacity of rural, and especially indigenous, communities to ensure food security into the future, and this matter is certainly of importance to scholarship in environmental management. Thus, the aim of this research is to document how personnel working in formal institutional settings in Sri Lanka view two agroecological farming systems.

More specifically, I ask the question: *How do administrative officials and agricultural professionals perceive agroecological farming systems in Sri Lanka?* I have determined three research objectives to document official and professional perceptions of (1) sustainable agriculture; (2) indigenous knowledge of and practices in chena cultivation (a form of shifting cultivation) and Kandyan homegardens (a form of agroforestry); and (3) institutional conditions that influence those agroecological farming systems. The point of the first research objective is to understand how administrative officials perceive the sustainable agriculture paradigm. Against this backdrop, the rationale behind the second objective is to describe and analyse their views on agroecological farming systems with reference to chena cultivation and Kandyan homegardens. The intention of the last objective is to garner an understanding of officials' and agricultural professionals' perspectives on policies that influence the aforementioned farming systems.

Significance of the Study

Modern agriculture has had a profound impact on the global food system. The current food system is undeniably productive -- per capita food produced has risen since the mid 1960s by seven per cent globally, with the highest increases in Asia where per capita food production

has risen by about 40 per cent (Pretty, 1995). However, a persistent problem has been that the growth in food production has remained poorly distributed. Hunger is still widespread (FAO, 2003; Pretty, 1995; Rosset, 2000) and is one of the most extreme indications of poverty and human deprivation. While hunger impinges on the most basic of human rights, the right to adequate food, it also has significant economic costs, severely impeding the productivity of individuals and communities, and the progress of nations.

According to Rosset (2000) the global food system is caught up in a crisis that cuts across many fronts. Modern agriculture is unsustainable on three grounds. First, in ecological terms, modern agriculture has compromised productive capacity of the agroecosystems with its intensified use of external inputs and narrowed genetic base. Second, in economical terms, the cost-price squeeze resulting from rising production costs and dwindling returns from farm produce, continues to cause severe financial losses to millions of farmers worldwide. Finally, in social terms the dominance of agribusiness corporations, extending more and more control over commodities, has made small scale farming unprofitable to the extent of driving small farmers to pauperism. These are clear signs that the agribusiness food system falls far short of adequately addressing social or environmental concerns.

In fact, not all forms of agriculture have followed the path dictated by advocates of the Green Revolution. Complex systems remain that are based on low inputs and located in a range of different environmental settings such as drylands, wetlands, uplands, savannahs, swamps, near-deserts, mountains, hills and forests. These systems are often found on marginal lands situated in remote areas away from markets and roads. Their yields are usually low, yet rural livelihoods are often successfully dependent on these systems. Pretty (1995) describes these subsistence farming systems as *forgotten agriculture* and appropriately so, since they have remained largely ignored by agricultural scientists, extension workers and research institutions.

By the mid 1990s some 30-35 per cent of the world's population, (about 1.9 – 2.1 billion people) relied on this *forgotten agriculture*. Yet these systems, which are mostly concentrated in developing regions, are often excluded from development assistance and marginalised by policy makers. Paradoxically, most agricultural development assistance has favoured the 'modernization paradigm' with its emphasis on external resources, when people can rarely afford to sustain the use of external resources. In recent times however, low input systems

using resource-conserving technologies have been recognized as an alternative more appropriate for resource poor farmers. Nierenberg and Halweil (2005, 63) note that

just as the threats -- both new and old -- to food security are numerous, so are the solutions. Our most important tool is not new chemicals or fertilizers or genetically engineered seeds but a new approach to farming that depends on the knowledge of farmers and a sophisticated use of the environment around them.

Food security remains a crucial policy issue in developing countries as well as for the whole world (Dixon, *et al.*, 2001; FAO, 2002). Undeniably, modern agricultural activities produce the bulk of food in Sri Lanka. Nevertheless, subsistence farming is significant for the livelihoods of the rural poor, and for the protection of the environment, although these systems have been largely disregarded on an institutional level.

The wider challenge is for institutions to 'learn' and for multiple perspectives, diversity, and farmer participation to be valued in seeking solutions to issues faced by farmers. An enabling policy environment is crucial in meeting this challenge. In order to establish forms of agriculture that are sustainable by being responsive to the needs of ecological and social systems, it is imperative that the state plays a supportive role (Dixon *et al.*, 2001). The need for an enabling policy environment is also echoed by the FAO (2004a) as one of the components essential to institutional capacity¹ for ensuring food security. With few exceptions, most policy frameworks are still highly biased towards promoting agriculture dependent on external resources (Pretty, 1995).

Robinson *et al.* (2001, no page) note that 'by presenting *particular views* of the truth as *the truth* and particular people and institutions as the holders or adjudicators of *the only truth*' institutional actors are able to circumscribe the parameters of *reality*. In order to understand the nature of institutional dynamics in Sri Lankan agricultural policy, it is necessary to apprehend the manner in which those within the institutional structures describe *reality*. How then, are the indigenous chena cultivation and Kandyan homegarden methods (re)presented by institutional actors in Sri Lanka, and to what effect? What of agroecology and

¹ In ensuring food security the FAO (2004a) recognizes the importance of institutional capacity that is required for collaboration among disciplines, research efforts, institutions and sectors. Institutional capacity itself has been viewed as being dependent on infrastructure, financial resources, human resources and an enabling policy framework.

sustainability more generally? In exploring these questions, I focus on eliciting the multiple perspectives of personnel engaged in agricultural research and policy because ‘truths co-exist and add richness to human experience’ (Robinson *et al.*, 2001, no page). Guided by this aphorism, I seek to document and understand the range of attitudes that institutional personnel hold about agroecological farming systems in relation to Sri Lanka’s agriculture sector. Findings from my work will have implications for policy formulation and implementation for natural resource managers as they attempt to garner an understanding of the underlying value systems and tacit beliefs of those within the institutional structure. In addition, the work will contribute to an understanding of institutional and policy dynamics at play within the complex ecological and social terrain of resource poor farmers in Sri Lanka.

Approach and Methodology

This study is indebted to qualitative research methods. Qualitative research methodologies have grown in prominence as an important mode of inquiry in the social sciences over the years (Miles and Huberman, 1994; Marshall and Rossman, 1999; Winchester, 2000). The emphasis on ‘lived experience’ in qualitative research means that the methods are ideally suited to uncovering the meanings that people associate with events, processes and structures of their lives by way of perceptions, suppositions and preconceptions (van Mannen, 1977). Similarly, the qualitative paradigm provides both the means to explore the complexities of the social world, including the labyrinth of conceptions, interpretations and experiences of the research participants, and mechanisms to disclose the dynamics of social processes, interactions, institutions and discourses (Mason, 2002). In particular, my research approach is situated within the sphere of discourse studies, which deal with the narration and interpretation of a variety of complexities within the lived experience (McKenna, 2004). A review of academic and policy literature as well as pertinent information on the World Wide Web on discourses such as sustainable agriculture, agroecological farming systems, policy and governance also informs my research.

In meeting my research objectives I also use questionnaires, and hermeneutic and discourse analyses of them, to conduct my investigation. I designed and utilized two sets of questionnaires whose design is indebted to the literature on sustainable agriculture, agroecology, and agricultural policy. Questionnaire A (Appendix 1) was directed to

administrative officials from the Department of Agriculture. It is in semi-structured format and includes Likert scale and open-ended questions. Questionnaire B (Appendix 2) was directed to agricultural professionals and consists entirely of open-ended questions. The Likert scale allowed for the 'unambiguous ordinality of response categories' (Babbie, 1992, 180) while the open-ended questions elicited respondents' understanding and points of view without predetermining these through questionnaire categories (Patton, 2002). To ensure careful design and rigour of the questionnaires, I requested my supervisor and peers to review and comment on their structure, composition, content, rigour and sense. Then, after gaining ethics approval from the University of Tasmania to undertake the collection of primary data using the questionnaires, I forwarded an invitation and project information sheet (Appendix 3), together with a relevant questionnaire, to selected participants. Their recruitment is described below.

Two focal points in this research are the chena cultivation, which is a dry zone agroecological farming system, and the Kandyan homegarden system, which is a wet zone agroecological farming system in Sri Lanka. I have confined my study to the districts in which these two farming systems are widespread. In order to ensure administrative officials who are familiar with chena cultivation are represented in this study I selected participants from Anuradhapura District (Figure 1) located in the North Central Province and the Puttalam District (Figure 1) located in the North Western Province of Sri Lanka where chena farming is extensively practised. Likewise, to ensure that administrative officials who are familiar with the Kandyan homegarden system are represented in this study I selected participants from Kandy District (Figure 1) located in the Central Province of Sri Lanka where the Kandyan homegardens are prevalent. Respondents were selected based on availability. In order to ensure that an equal number of respondents familiar with each type of farming systems is represented, from Anuradhapura and Puttalam Districts I selected 25 out of a total of 56 officials (to represent officials familiar with chena cultivation), and from Kandy District I selected another 25 out of a total of 36 officials (to represent officials familiar with Kandyan homegardens). From all three districts I selected a total of 50 administrative officials out of a total population of 92 officials, who represented three different decision making hierarchies namely the district² level, division³ and the village⁴ levels. Out of the 50 officials invited to participate in the research, 33 responded to the questionnaire.

² A province is composed of several districts.

³ A district consists of several divisions.

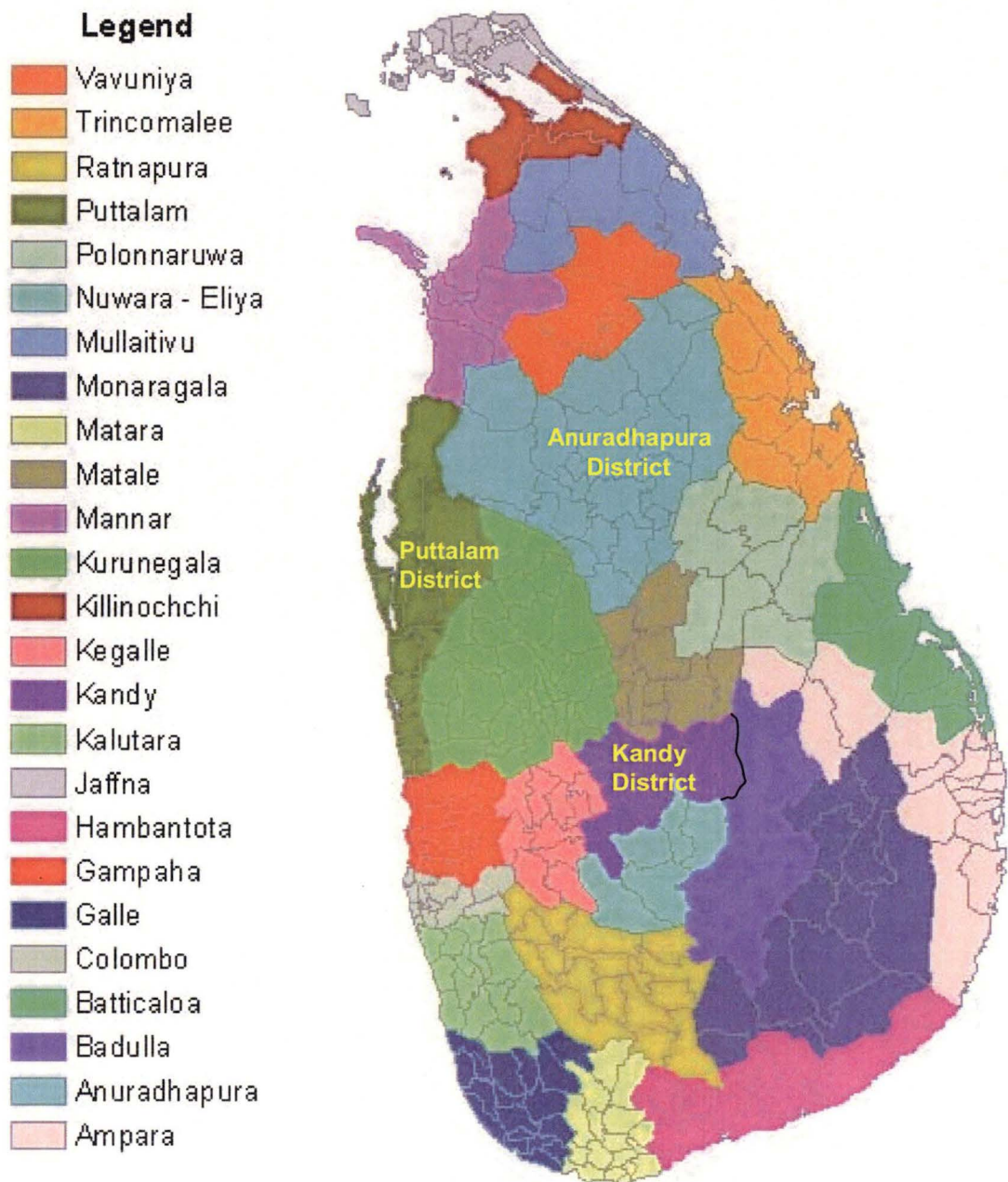


Figure 1: Administrative Districts of Sri Lanka

Source : Recoverlanka (2005)
www.recoverlanka.net/maps/background.html

This research is also a bilingual project. Although I originally formulated Questionnaire A, intended for this group of 50, in English, I later provided the participants with a Sinhalese⁵ translation at their request to remove any linguistic barriers to the reliability of data. I then undertook careful translation of the responses and transcribed these into English, ensuring that the meanings are not lost. I refer to respondents from this group as 'RA' denoting 'respondent' to Questionnaire 'A'. Numerals following this abbreviation indicate the numbers that are designated to the respondents.

I selected another group of respondents from among agricultural professionals who are knowledgeable in the two systems of agroecological farming and are also influential in policy making and directing at the national level. The selection of this group followed the principles of what Marshall and Rossman (1999) term elite interviewing, where elite individuals are chosen as respondents on the basis of their influence, prominence or expertise within a community or organization, in the areas pertinent to the study. I selected 10 agricultural professionals from policy making and academic backgrounds, affiliated with institutions that clearly influence agricultural policy in Sri Lanka such as the (a) Department of Agriculture; (b) Hector Kobbekaduwe Agrarian Research and Training Institute; and (c) Faculty of Agriculture at the University of Peradeniya. I distributed Questionnaire B among the 10 respondents invited to participate and six responded to my request. I refer to respondents from this group as 'RB' denoting 'respondent' to Questionnaire 'B'. Numerals following this abbreviation indicate the numbers that are designated to the respondents.

In general, hermeneutics (a method of careful and reflexive interpretation) is core to qualitative inquiry and allows analyses to be meaningful of the context and relations between and among the constituent parts of a research process. Hermeneutics offers a frame of reference to interpret and understand respondents' replies, taking into account the context for the material (Patton, 2002). The nature of textual interpretation of meanings is clarified by Kvale (1987, 62) as follows:

The interpretation of meaning is characterized by *hermeneutical circle* or spiral. The understanding of a text takes place through a process where meaning of the separate parts is determined by the global meaning of text. In principle such a hermeneutical

⁵ Sinhalese is the first language of respondents.

explication of the text is an infinite process while it ends in practice when a sensible meaning, a coherent understanding, free of inner contradictions has been reached.

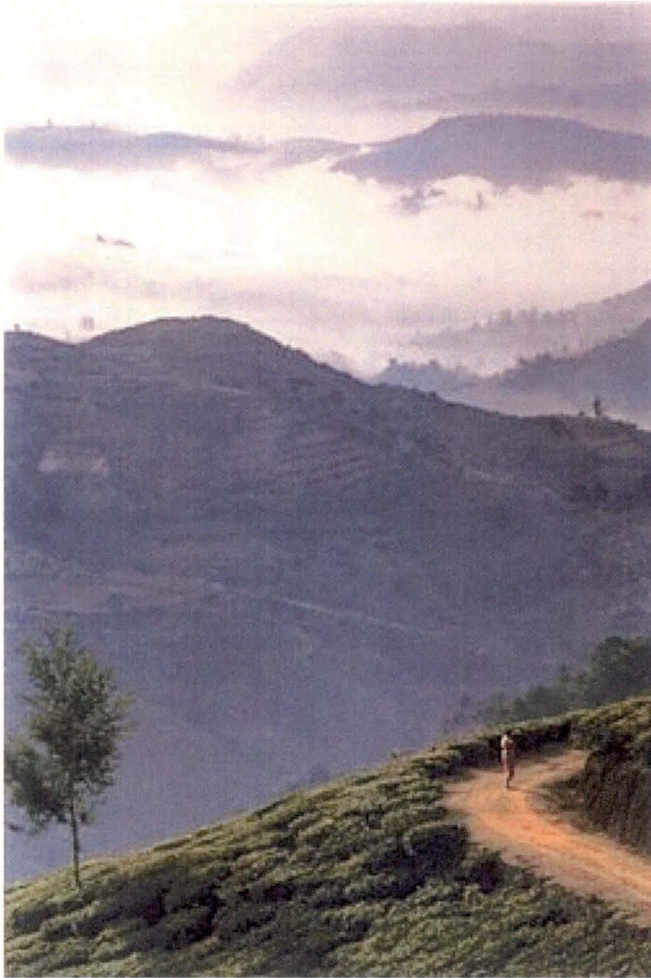
It follows that, within the hermeneutic tradition, interpretations are never considered as *absolute truths* (Patton, 2002).

In order to draw out the meanings embedded in questionnaire responses, I searched for themes across the participants' narratives as these were recorded in answer scripts. The critical analysis of language to seek out implicit meanings either in speech or texts is known as discourse analysis and covers a multiplicity of different approaches varying according to their research focus, aims and techniques that they employ (Hammersley, 2002). In this research I deploy discourse analysis to unveil layers of meaning in participant responses. A discourse can be described as a collection of stories, narratives, scripts and other communications that causally connect events. Discourse analysis is useful in deconstructing various forms of communication to unearth the tacit assumptions, and ethical positions held by people, and organizations that function within the public policy arena. Although discourse analysis covers a variety of research practices, most researchers have used discourse analysis to draw attention to the significance of environmental discourse in environmental management (Butteriss *et al.*, 2001). For the aforementioned reasons, discourse analysis can be considered as an appropriate analytic tool for this study.

Chapter Outline

In this Chapter I have presented the research aim and objectives and the approach and methodology that I have employed in exploring perceptions relating to agroecological farming systems in Sri Lanka, held by people within institutional structures. I have also justified the focus of this study by elucidating the significance of the study for environmental management and have also provided a detailed discussion on the research design. The purpose of Chapter Two is to examine a range of theoretical contexts related to sustainable agriculture, agroecological farming systems and policy frameworks that underpin the research. In addition I provide an overview of chena cultivation and the Kandyan homegarden systems that are a focus of this work. In Chapters Three through to Six I address a number of topics relevant to my research that emerged from the analysis of primary and secondary materials: namely, perceptions of institutional personnel regarding sustainable agriculture; agroecological

production systems; chena cultivation and Kandyan homegardens; and institutional matters. In these chapters I provide a discourse analysis of the participants' responses, to unveil meanings. In Chapter Seven I present a synthesis, and conclusion of the research findings -- that is various environmental and social themes pertaining to chena cultivation and the Kandyan homegardens that are embedded in the attitudes of institutional personnel.



Chapter 2

Overview

Photo: Luke Powell, 1996



Photo: Dominic Sansoni, 2002

CHAPTER 2

Overview

In this chapter I provide a contextual overview of areas relevant to this research. I briefly examine global challenges to agriculture and food security as well as an agroecological approach to addressing these challenges. In addition, I describe two agroecological farming systems that concern this study -- namely, chena cultivation and Kandyan homegardens. I also provide a brief overview of Sri Lanka's agricultural policy environment.

The Global Challenges in Agricultural Production

Food and Hunger

The 1996 World Food Summit pledged allegiance to halve the number of people suffering from hunger by 2015 -- a goal which was later incorporated into the Millennium Development Goals (FAO, 2003). It is estimated that nearly 2 billion people worldwide suffer from hunger and chronic nutrient deficiencies (Nierenberg and Halweil, 2005). The enormity of the problem and the increasing difficulty faced in addressing hunger and access to food even on a short-term basis raises serious doubts regarding the possibility of mitigating the effects of this crisis in a sustainable manner.

Hunger violates human dignity and poses major barriers to social, economic and political progress. A rights-based approach to food security acknowledges that people have a fundamental right to be free from hunger. The right to food¹ requires the State to take all possible measures to ensure that individuals have physical and economic access to sufficient, nutritious and safe food to lead active and healthy lives. Research has revealed that there is a definite link² between civil and political freedoms and economic growth. Therefore, attention to food rights demands attention to ethical considerations and to effective development

¹ A common misconception associated with the right to food is that it requires the State to provide free food to its people. This is not so and instead requires that the State respect and protect the rights of individuals to feed themselves. Free food assistance is only called for during emergencies and natural disasters (FAO, 2004b).

² According to Nobel Laureate Amartya Sen, famines are much less likely to arise when basic civil and political rights are honoured (FAO, 2004b).

strategies (FAO, 2004b). In order to ensure food rights, various factors are to be addressed from access to land to sufficient opportunities for generating income. The Covenant on Economic Social and Cultural Rights of 1976 assigned to national governments the primary responsibility to ensure food rights. This covenant is operational through States' obligations to respect³, protect⁴ and fulfil⁵ the right to food (FAO, 2004b). The State's 'obligation to fulfil' is especially significant in terms of agricultural policy formulation as this requires governments to institute policies that improve access for vulnerable groups to food-producing resources. International law⁶ establishes that everyone has the right to be free from hunger and 22 countries, including Sri Lanka have subsumed this basic human right as a constitutional edict. However, governments of these 22 countries have yet to institute legislative measures to implement this right.

Agricultural Production

With the world population expected to reach 8 billion by 2030, people are faced with the challenge of having to produce sufficient food for an increasing population (FAO, 2004b). Feeding a burgeoning population in a 'sustainable' manner entails preserving and enhancing the natural resource base; this appears to be a tremendous challenge globally because of the following factors. The size of arable land per person has contracted from 0.38 hectares in 1970 to 0.23 hectares in 2000, with a projected decline that will further reduce arable land per person to 0.15 hectares by 2050. Soil erosion is responsible for about 40 per cent of land degradation worldwide, much of it being caused by tillage. Irrigated land is damaged by waterlogging or salinity and about 20 per cent of the irrigated lands in the developing world have been thus affected. An estimated 250 million people have been directly affected by desertification while nearly 1 billion are at risk. Finally, about 30 per cent of livestock breeds are close to extinction and about 75 per cent of the genetic diversity of agricultural crops has been lost since 1900 due to genetic erosion (FAO, 2004c).

³ Respect limits the State's authority to interfere with individuals' livelihoods. If national legislation contravenes this then immediate corrective action must be taken (FAO, 2004b).

⁴ Protection requires regulations against non-State actors who might constrain people from acquiring adequate and safe food. Its coverage extends to food hygiene, quality, market practices, labour conditions, land tenure and labelling standards (FAO, 2004b).

⁵ Fulfilment requires the State to identify and assist vulnerable groups to achieve food security (FAO, 2004b).

⁶ The Rome Declaration on World Food Security 1996, The International Covenant on Economic, Social and Cultural Rights, 1966 and the Universal Declaration of Human Rights, 1948 decree that everyone has the right to adequate food (FAO, 2004b).

Nierenberg and Halweil (2005) point out that Green Revolution technologies, which were developed to enhance agricultural productivity since the 1960s, are ironically contributing to the vulnerability of agroecosystems. The predicament of modern agriculture is universal, embracing both developed and developing nations (Rosset, 1997). The pursuit of increased productivity for profit has entailed environmental costs such as damage to ecosystems; environmental contamination⁷; over-use of natural resources⁸; soil erosion⁹; elimination and loss of natural crop varieties¹⁰; and health hazards to agricultural workers¹¹. Similarly, this situation has not excluded social costs such as social inequities in resource use, the displacement of resource poor farmers, or the marginalisation of women (Pretty, 1995).

Although modern agriculture reliant on high inputs will continue to dominate global primary production, there is great uncertainty about its ability to provide sustained yields because its ecological foundations are being threatened (Gliessman, 2000). For example, there is growing evidence of declining yields in mono-cropped modern cereals detected in experimental stations at the International Rice Research Institute (IRRI) in the Philippines and many other research stations elsewhere. In this situation reversal of yield declines has only been possible by increasing fertilizer applications by 50 per cent. Possible explanations for this decline could be pests, disease, chemical toxicity, changing soil carbon-nitrogen ratios and chemical deficiencies. In any case, if stagnating yields can be increased through technological breakthroughs and made available to resource poor farmers as a package that must be repurchased every planting season their cycles of dependency on external inputs and systems will be reinforced. This outcome will further disadvantage developing countries, which are already constrained by limited resources and infrastructure (Pretty, 1995).

But the institutional bias towards the 'modernization paradigm' remains firm as the bulk of the world's food come from irrigated or fertile rainfed lands in contrast to the small yields

⁷ Contamination of: (a) water by pesticides, nitrates, soil and livestock wastes; (b) food and fodder by residues of pesticides, nitrates and antibiotics; (c) the atmosphere by ammonia, nitrous oxide, and methane (Pretty, 1995).

⁸ Over-use of natural resources has caused: (a) depletion of groundwater; (b) loss of habitat for wildlife; (c) loss of ecosystem capacity to absorb wastes (Pretty, 1995).

⁹ Worldwide soil erosion due to agricultural activity was estimated to be 21 billion metric tons in 1981 (Soule *et al.*, 1990). As much as 40% of the land degradation is caused by soil erosion arising from tillage (FAO, 2004c).

¹⁰ The planet's ecological and genetic diversity erodes as practitioners of modern agriculture convert vast areas to monocultures (Soule *et al.*, 1990). The world's 1440 million hectares of agricultural landscape contain only about 70 plant species – some 12 species of grain crops, 23 vegetable crops and about 35 species of fruits and nuts, in contrast to 1 hectare of rain forest which typically contains over 100 plant species (Thrupp in Altieri, 1999).

¹¹ According to estimates made by the World Health Organization (WHO) in 1990, a minimum of 3 million and perhaps as many as 25 million people suffer pesticide poisoning each year leading to more than 200,000 deaths. Mortality and illness due to pesticides are more common in developing countries (Pretty, 1995).

obtained from low input traditional forms of agriculture usually occupying marginal areas. Therefore, irrigated or fertile rainfed lands, which have high agricultural potential are readily earmarked for further improvements by policy makers, and development activities are usually directed towards these high potential areas. A much broader strategy has been to develop agriculture and other income generation activities within these high potential areas in order to encourage migration of people away from marginal lands. However, such an approach has pushed low input traditional agricultural systems in marginal areas to the periphery of the development agenda leaving them largely neglected (Pretty, 1995).

Nevertheless, it is encouraging to note that in recent times these systems are beginning to gain attention from both national and international research institutions (Altieri, 1999; Gliessman, 2000; Pretty, 1995). By understanding the ethnoscience¹² of farmers who farm in complex environments, and by appreciating the salience of features inherent in traditional agricultural systems such as adaptations for risk aversion, production efficiencies and symbiotic crop mixtures, appropriate agricultural strategies that are more sensitive to their complex ecological and social terrain can be developed and maintained.

It is now widely recognized that modern agriculture, has been mostly incongruous with the needs of resource poor farmers and unsuited to their social and environmental circumstances (Altieri, 1990). Yet in many developing countries, the policy environment actively favours input-intensive technologies -- including many Green Revolution technologies as opposed to environmentally benign alternatives. As a case in point, fertilizer subsidies discourage soil conservation practices (since farmers use fertilizer to offset productivity losses due to soil degradation); pesticide subsidies discourage integrated pest management; and irrigation subsidies discourage water conservation (Blackman, 2001).

Many analysts point out that during the Green Revolution those with larger land sizes and better access to resources often benefited from new technologies and methods, but that small farmers with marginal resources lost out, creating ever widening income disparities (Altieri, 2002). It is evident that the ecological disasters and social setbacks that have surfaced in modern agriculture have reached a critical juncture. Even so,

¹² The term ethnoscience is used interchangeably with traditional knowledge, indigenous technical knowledge and rural knowledge (Altieri, 1990).

The outlook is not entirely bleak, for solutions to all these problems lie in lessons we have learnt and can still learn from nature. If we turn our attention away from the extractive industrial model and begin to focus on nature's models of productive ecosystems as our guide for agricultural systems we may yet see truly sustainable agriculture emerging. It isn't that nature learns faster than humans. It is just that she has been at it longer (Soule *et al.*, 1990, 185).

In view of spiralling demands on the natural resource base, an ecosystems approach to agriculture incorporating strategies such as integrated production management, conservation agriculture¹³, organic agriculture¹⁴, integrated pest management¹⁵, is being recognized as the appropriate course of action (FAO, 2004c). However, economic pressures usually impel farmers to grow crops ignoring such resource-conserving practices (FAO, 2004a). In the analytical literature there is general consensus that environmental damage is costly to regional economies in Asia. In a broader sense, economic policy usually has implications for agriculture and natural resource management. This connection is highlighted by Coxhead (2003, 22), who argues that 'environmental and economic policies interact: in effect, every economic policy that affects resource allocation is a *de facto* environmental measure'. All these factors point to the need for institutional reforms, and a range of policy instruments and measures to address the needs of resource poor farmers.

The FAO's position on such matters is that public policy needs to advocate sustainable agriculture or more specifically an ecosystems approach that takes into account economic, social and environmental factors. This position highlights the significance of support that must be provided by policy and institutional structures by legitimating necessary tenets for sustainable outcomes. This support may require a national policy for sustainable agriculture which emphasizes the adoption of resource-conserving technologies while giving value to socio-economic needs. Such a framework may also entail policies that enable and create conditions for agriculture that is based on local skills, knowledge and resources; better linkages between farmers and institutional structures; and effective partnerships with external institutions (Pretty, 1995).

¹³ A strategy to improve soil fertility through nutrient cycling, low or no-tillage, mulching, and prevention of wind erosion (FAO, 2004c).

¹⁴ A strategy to optimise health and productivity of soil, plants and animals by excluding all synthetic inputs (FAO, 2004c).

¹⁵ A strategy to prevent pest outbreaks through naturally occurring predators, parasites, pest resistant varieties and traditional cultural methods (FAO, 2004c).

Sustainable Agriculture

The 1987 Report of the World Commission on Environment and Development states that sustainable development is 'development that meets the needs of the present without compromising the ability of the future generations to meet their own needs', while pointing out that technology, social organization on environmental resources and the absorptive capacity of the environment to be limiting factors. Somewhat optimistically the Commission also notes that if these limitations can be effectively managed, sustainable development can lead to economic growth and poverty alleviation (World Commission on Environment and Development, 1987, 24). This definition has been heralded as the most widely quoted definition for sustainable development. However, numerous other definitions have also been circulating among both academics and policy makers (Sachs, 1999).

Notwithstanding the rhetoric, the Brundtland Report presents an inconsistent set of goals¹⁶ identified as crucial for sustainable development (Meadows, 2000). For example, according to Glasby (2003) rapid economic progress has been highlighted as imperative for both developed and developing countries if economic, social and environmental decline is to be averted. Can rapid growth actually avert environmental decline? The ambivalence of the term *sustainable development* itself seems to suggest a range of possibilities often leading to incongruity and policy stalemate (Torgerson, 1995; Redclift, 1990). Not only are the definition and the delineated goals problematic, but the varying shades of meaning associated with the use of the word 'sustainable' further confounds the matter. At one end of the spectrum of its meaning the term 'sustainable' is used with precision regarding the long term future of humanity. In the middle of the range, it is used as a modifier to describe activities that may yield long-term benefits or be merely viable in a limited number of dimensions. At the other end of the spectrum it is used to present in a more favourable light activities that may not be capable of continuing over a long period of time or that while viable contribute to ecological, social and economic problems. A more extreme position is when the term is used in an oxymoronic sense as in the concept of 'sustainable development' since ongoing development when construed as growth is contradictory to the act of sustaining (Bartlett, 1998).

¹⁶ The goals that were identified as being focal for achieving sustainable development by the Brundtland Commission were: reviving growth; changing the quality of growth; meeting essential needs for jobs, food, energy, water, and sanitation; ensuring a sustainable level of population; conserving and enhancing the resource base; re-orienting technology and managing risk; and merging environment and economics in decision making (Glasby, 2003).

Despite the ambiguity of the concept it is possible to arrive at some understanding of the term 'sustainable agriculture' in terms of the larger goals of sustainable development. As a system of food and fibre production it aims to (a) incorporate natural processes; (b) reduce dependence on external inputs and non-renewable resources; (c) promote equitable access to resources and socially just forms of agriculture; (d) increase biological and genetic diversity; (e) productively incorporate local knowledge and practices; (d) promote self reliance among farmers and rural people; (f) promote adaptive practices to suit environmental circumstances; and (g) emphasize integrated farm management and conservation of soil, water, energy and biological resources (Reijntjes *et al.*, 1992; Pretty, 1995; Gliessman, 2000). Fundamentally these goals emphasize three key themes: environmental protection, economic viability and social equity.

Most research on sustainable agriculture makes clear reference to the environmental, social, and economic dimensions that constitute this field. Environmental concerns highlight effects that are to be desired (that is, resource conservation) or averted (that is, resource degradation). At the same time social concerns articulate the necessity of meeting human needs and goals. Emphasis on economic goals such as productivity and profitability are also woven into these ideas. For example, sustainable agriculture is seen as a system that strikes a fine balance between reduced environmental degradation and enhanced productivity and profitability, while ensuring quality of life for the communities involved in the process (Francis and Youngberg, 1990; Gliessman, 1998; SARE, 2003; SAREP, 1998). It is also not uncommon to find the idea of holism in definitions of sustainable agriculture as a model based on the whole-systems approach to managing resources (Gliessman, 1998; O'Connel, 1992).

It has also been suggested that sustainable agriculture must be informed by science, as evinced by the idea that there is a need for 'application of latest scientific advances' (Francis and Youngberg, 1990, 8); or the notion that sustainable agriculture 'builds on current agricultural achievements, adopting a sophisticated approach' (Union of Concerned Scientists, 1999, no page). Given the prevailing idea that sustainable agriculture relies on 'appropriate and affordable technologies' (NGO Sustainability Treaty, 1992, no page) and not necessarily on the most advanced or sophisticated technologies, it is also a common theme in research that sustainable agriculture should use 'insights of modern science to improve rather than

displace traditional wisdom' (NGO Sustainability Treaty, 1992, no page), implying an approach that is both scientific and holistic.

Some analysts use temporal and spatial attributes to describe meanings for sustainable agriculture. For example, 'long-term (deep, fundamental) solutions' as opposed to 'short-term (shallow, symbolic) solutions' with respect to resource use are considered as relevant (Hill, 1992). Likewise, it is appropriate to envisage the sustainable farming system reaching from the individual farm to its immediate locality and to the broader community, both locally and globally (SAREP, 1998). In short, the spatial and temporal span of sustainability 'must be extended not only globally but indefinitely in time' (Gliessman, 1998, no page).

Yet there are those who argue that sustainable agriculture should not be defined because there can be no satisfactory definition. In describing the fluidity of meaning inherent in the concept Benbrook (1995) points out that any definition of sustainable agriculture is going to be a compromised understanding among different ideologies and value systems. In a similar vein, Ikerd (1998) concludes that there is unlikely to be a generally accepted definition of sustainable agriculture. Pannell and Schilizzi (1999, 65) propose the following in order to cope with such ambiguity:

There can be no satisfactory definition which is not multifaceted. This poses serious difficulties for the practical application of sustainability as an objective in real decision making. We have suggested here that these difficulties be addressed by focusing on the particular aspects of sustainability which the decision maker considers to be important, and presenting information about the trade offs between these aspects within a multiple criteria decision making formula.

From the multiplicity of understandings it is reasonable to consider an agricultural paradigm that is ecologically sound, socially just, economically viable and culturally appropriate as being indicative of a sustainable system.

Agroecology

There is the prevailing belief that in order to increase food production it is necessary to intensify efforts to modernize agriculture (Pretty and Hine, 2001). But the capacity of modernized systems to alleviate *food poverty* remains dubious when applied to ecologically vulnerable and resource poor areas in developing countries as conventional western technologies are based on different set of ecological and socio-economic circumstances (Altieri, 1995). In order to feed the world's poor, agriculture needs to be ecologically sound, economically affordable and locally adapted to the needs of farmers working on marginal lands (Pretty and Hine, 2001). In seeking sustainable models of agriculture some scientists view the convergence of traditional farming systems with scientific understanding and advances as the key to addressing this issue (Altieri, 1995). Dover and Talbot, (1988) describe this approach as the *agroecological* approach to feeding the world's poor.

In a contemporary sense the term agroecology came into existence during the 1970s. Nevertheless, the practice and science of agroecology can be traced far back as the origins of agriculture. Research is beginning to reveal that indigenous agricultural systems are actually vestiges of ancient agronomic forms and many locally developed agricultural systems frequently incorporate features from these earlier systems. These traditional systems are usually designed to weather the variability of the environment and thrive on locally available inputs. The objective is to manage 'resources' and not simply target crops. These production systems are designed to offset environmental and economic risk while maintaining the productive base of agriculture over time (Hecht, 1995).

Although, the original agroecological and agronomic models come under the category of 'traditional' or 'indigenous' agriculture, in its various representations 'agroecology' is now frequently used to describe any ecologically sensitive agronomic system that has a distinct socio-economic dimension. This attribute is made evident in the normative definition given by Hecht (1995, 4):

Loosely defined, agroecology often incorporates ideas about a more environmentally and socially sensitive approach to agriculture, one that focuses not only on production but also on the ecological sustainability of the production system.

This definition infers that agroecology goes beyond the mere ecological phenomena within the agroecosystem¹⁷ such as predator / prey relations or crop / weed competition (Hecht, 1995). Agroecology is founded on ecological principles where an agronomic system is viewed as a functional ecosystem. This idea is echoed in the definition given by Reijntjes *et al.* (1992) where agroecology is specified as the holistic study of the forms, dynamics and functions of agroecosystems encompassing all environmental and human constituents. Yet an even more extended use of the term 'agroecology' as a scientific discipline leading to a new paradigm for sustainable agriculture emerges in the following interpretation offered by Altieri (1989, 37):

In its various conceptions, agroecology has been proposed as a new scientific discipline that defines, classifies and studies agricultural systems from an ecological and socio-economic perspective. In addition to providing a methodology to diagnose the "health" of agricultural systems, agroecology should delineate the ecological principles necessary to develop sustainable production systems.

A major challenge to the agroecological approach is to determine how to increase agricultural productivity to a level that the rural poor can substantially benefit. This goal is contingent on farmers' access to land, water and other natural resources as well as appropriate technology, credit and markets. This situation becomes possible only if there is a progressive political and policy environment that enables the communities to influence institutions that govern access to resources and inputs. The agroecological approach can only delineate the ecological basis for resource management once resources are made available to the rural poor. In other words, agroecology is not capable of addressing rural poverty arising from weaknesses in institutional structures and economic factors. Such a situation will require a more broad-based development approach specially addressing the effectiveness of social organization within the rural sector (Altieri, 1989).

¹⁷ An agroecosystem is a site of agricultural production understood as an ecosystem. In practice an agroecosystem is generally equivalent to a farm. However the term could also be applied to a single crop field or a group of adjoining farms. Although human manipulation tends to make an agroecosystem quite different to a natural ecosystem the process, structures and characteristics of a natural ecosystem may be observed on an agroecosystem (Gliessman, 2000).

Sri Lanka

Located in the Indian Ocean between 5° 34' and 9° 52' Northern latitude and 79° 39' and 81° 53' Eastern longitude (Figure 2) Sri Lanka has a land area of 65,610 square km with a population of about 19 million (Figure 3). The average temperature is about 27°C in the lowlands while the central hills are cooler with temperatures dropping to about 14°C (Figure 4). The western, southern and central regions receive rains from the south-west monsoons from May to July while, the north and east regions receive rain from the north-eastern monsoons in December and January. The mean annual rainfall varies from below 1000mm in semi arid parts of the northwest and southeast of the island to over 5000mm in the south-western slopes of the central hills (GSL, 2004; Figure 5). Sri Lanka's vegetation and land cover are shown in Figure 6. Sri Lanka is endowed with a range of different agroecological regions that are distributed throughout the country. Ecosystems range from grasslands to rainforests, and rivers, wetlands and fresh water bodies to coastal and marine ecosystems. There is a high degree of biodiversity: for example 3800 flowering plants have been identified, of which 23 per cent are endemic. Likewise, there is a rich faunal diversity in the country. In fact, Sri Lanka is considered one of the 18 biodiversity hotspots in the world (MENR, 2002).

Being a democratic socialist republic, the legal and administrative structure of Sri Lanka is guided by its republican constitution. The President is elected to office by the people for a six-year term and exercises executive power. Members of Parliament are elected by the people, while the Prime Minister and Cabinet Ministers are appointed by the President. For administrative purposes the country is divided into nine provinces (Figure 7) and power is devolved to the provincial councils. Each provincial council is composed of members elected by the voters of the province, a governor appointed by the President and a chief minister appointed from among the elected members of the provincial council (MENR, 2002).

Table 1 provides a brief overview of various social and economic indicators in Sri Lanka in comparison with those of the South Asian region. From an economic model with increased central controls and social welfare which had a negative impact on economic growth in the 1970s Sri Lanka shifted to an open market economy pursuing accelerated economic growth in the late 1970s. Yet in the 1990s it was revealed that the later economic model largely ignored environmental concerns. As a result the government now aspires to adopt a balanced



Figure 2: Sri Lanka

Source: Perry-Castañeda Library Map Collection (2005)
www.lib.utexas.edu/maps/sri_lanka.htm

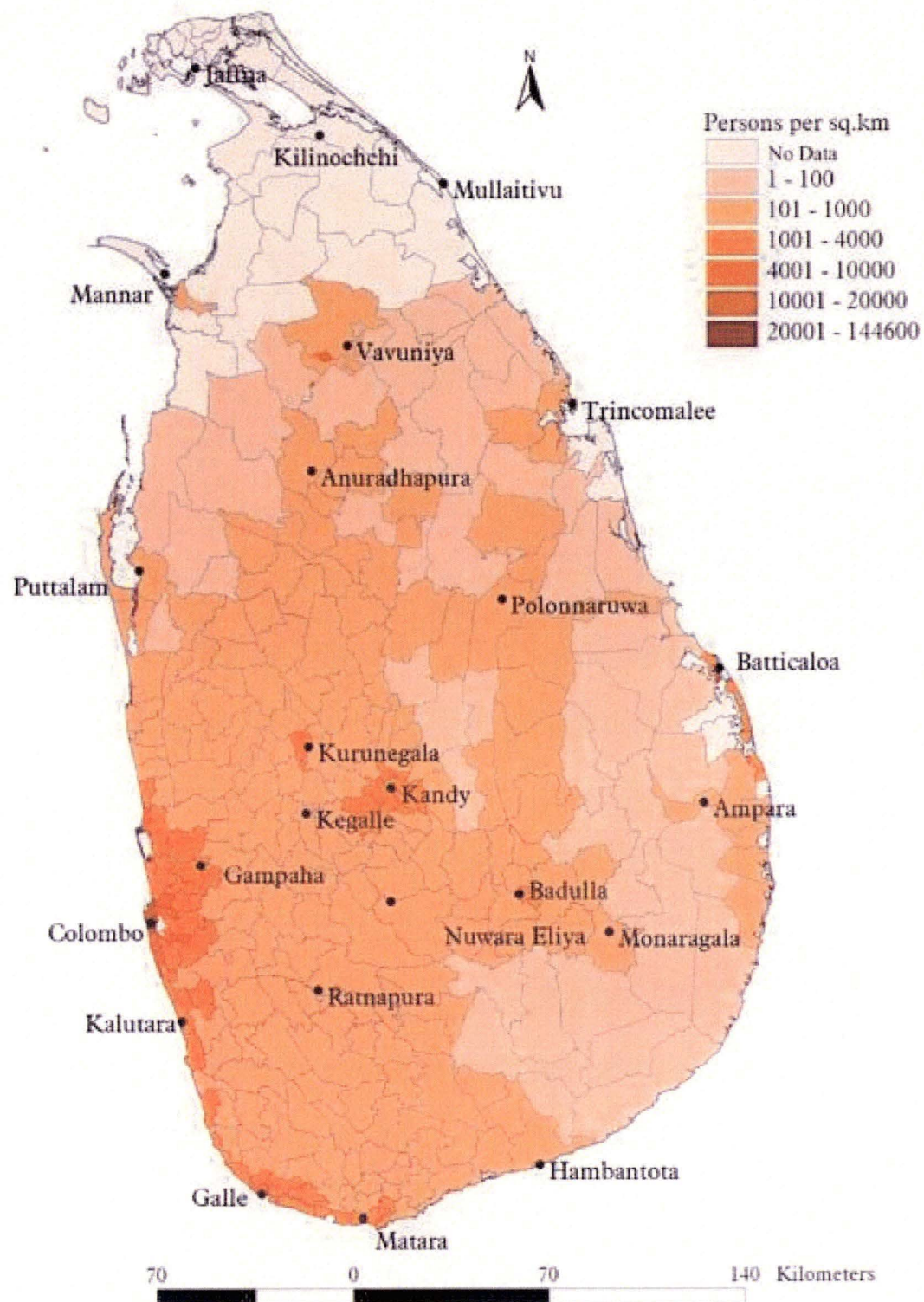


Figure 3: Population Density in Sri Lanka

Source : Recoverlanka (2005)
www.recoverlanka.net/maps/background.html

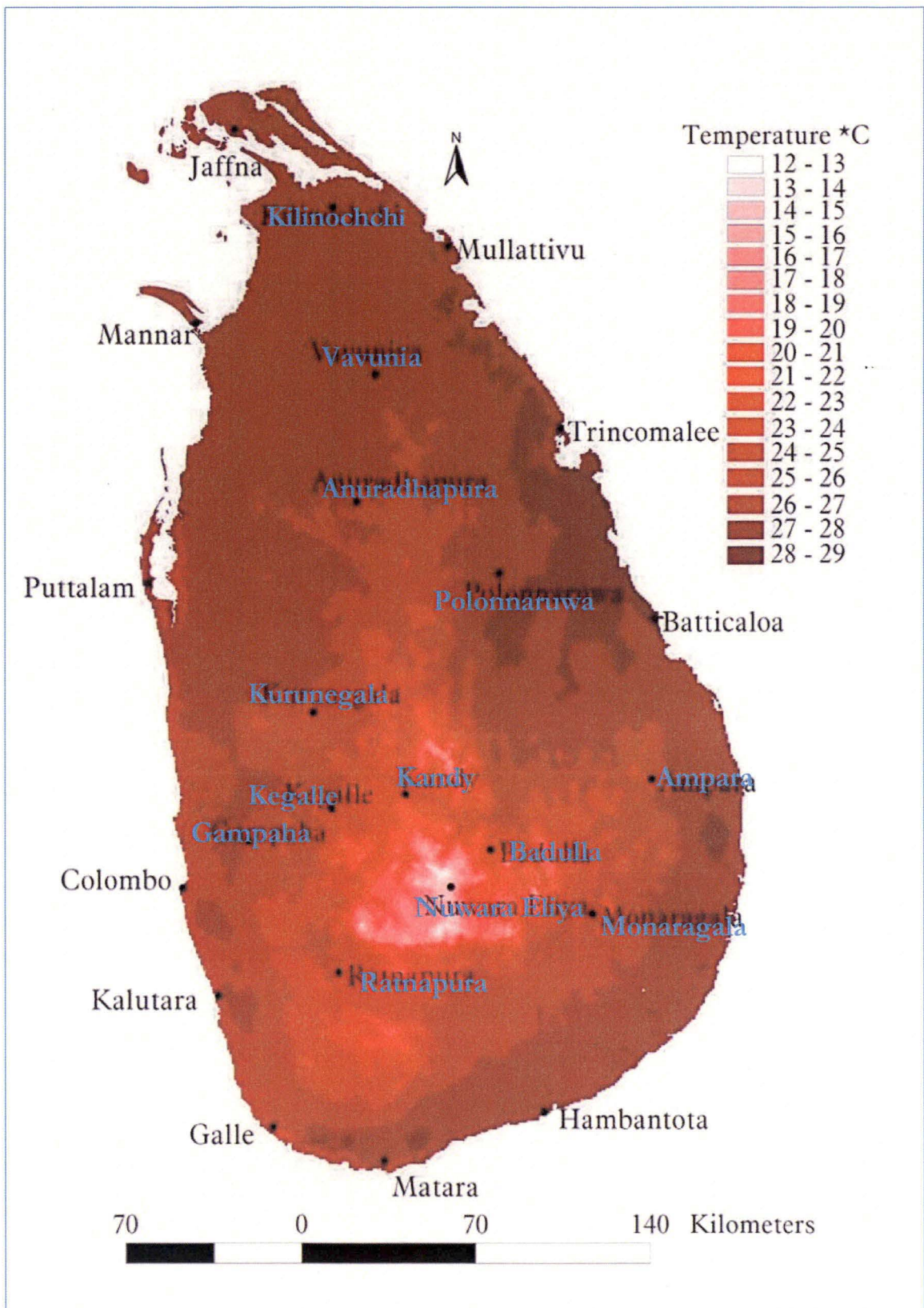


Figure 4: Average Annual Temperature (1961 – 1990)

Source: Recoverlanka (2005)
www.recoverlanka.net/mps/background.html

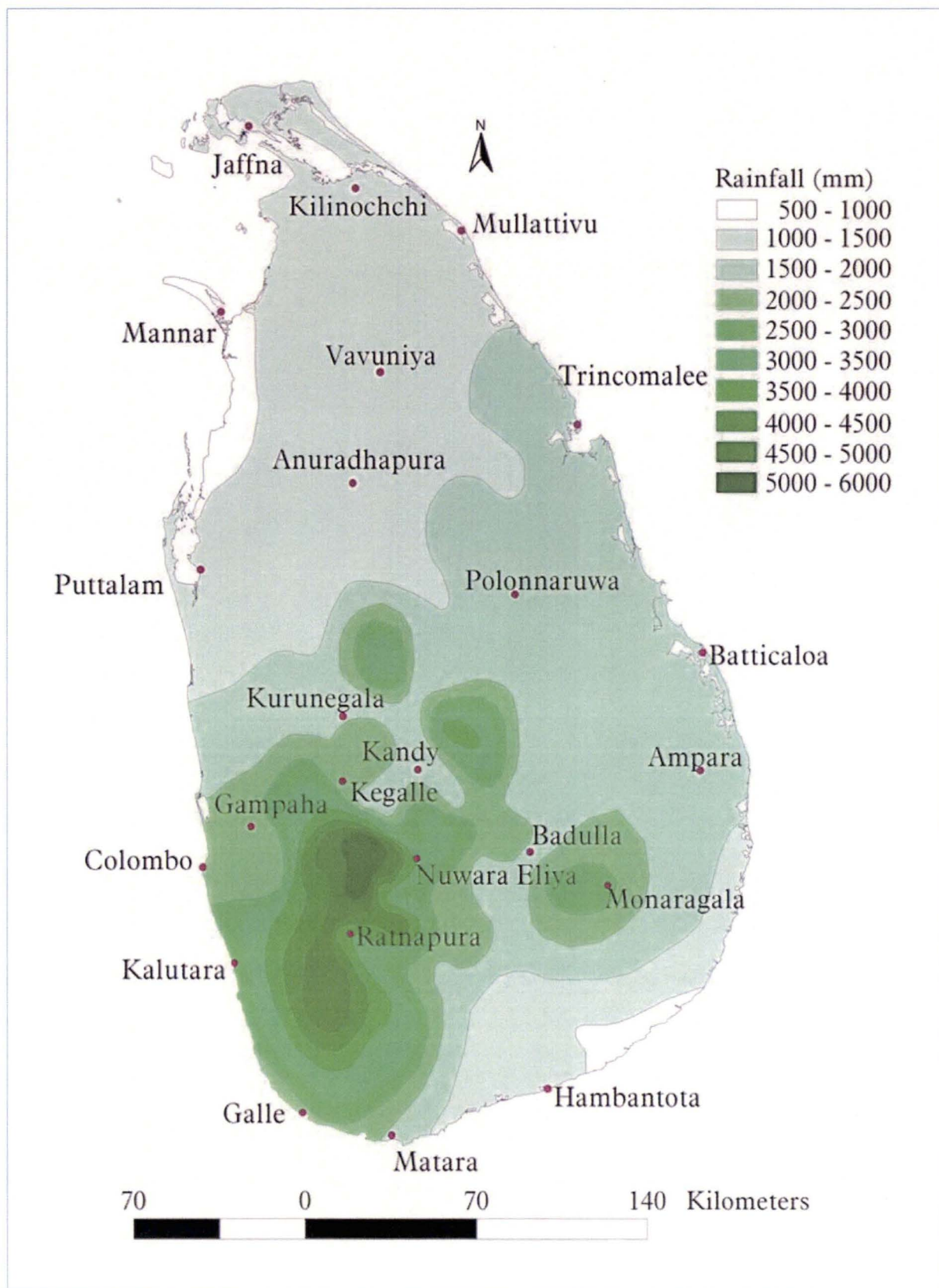


Figure 5: Average Annual Rainfall (1961 – 1990)

Source : Recoverlanka (2005)
www.recoverlanka.net/maps/background.html

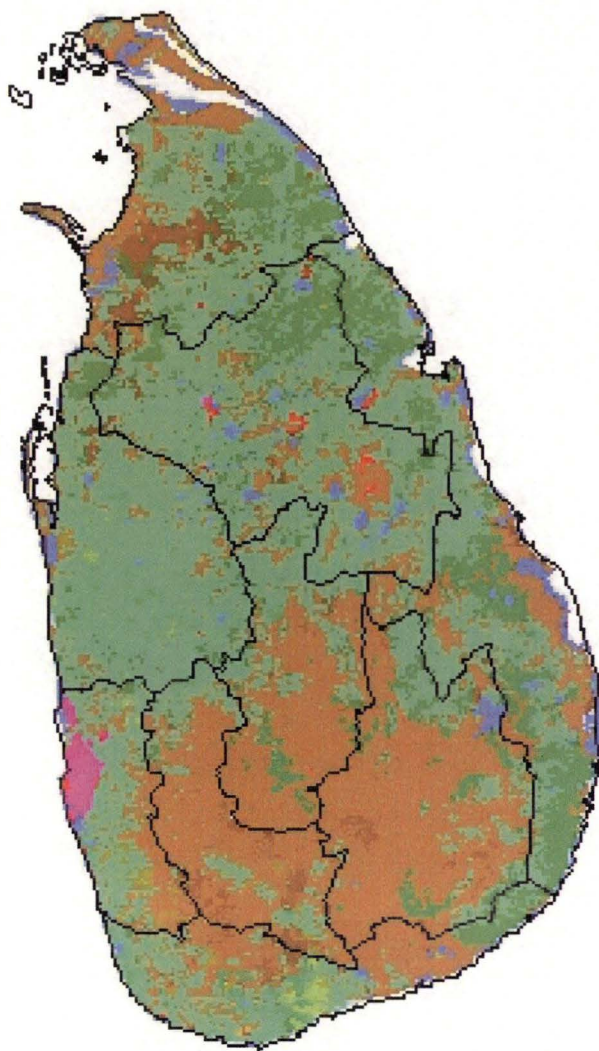


Figure 6: Land Cover in Sri Lanka



Source: FAO (2005)

www.fao.org/countryprofiles/map.asp?iso3=LKA&lang=en

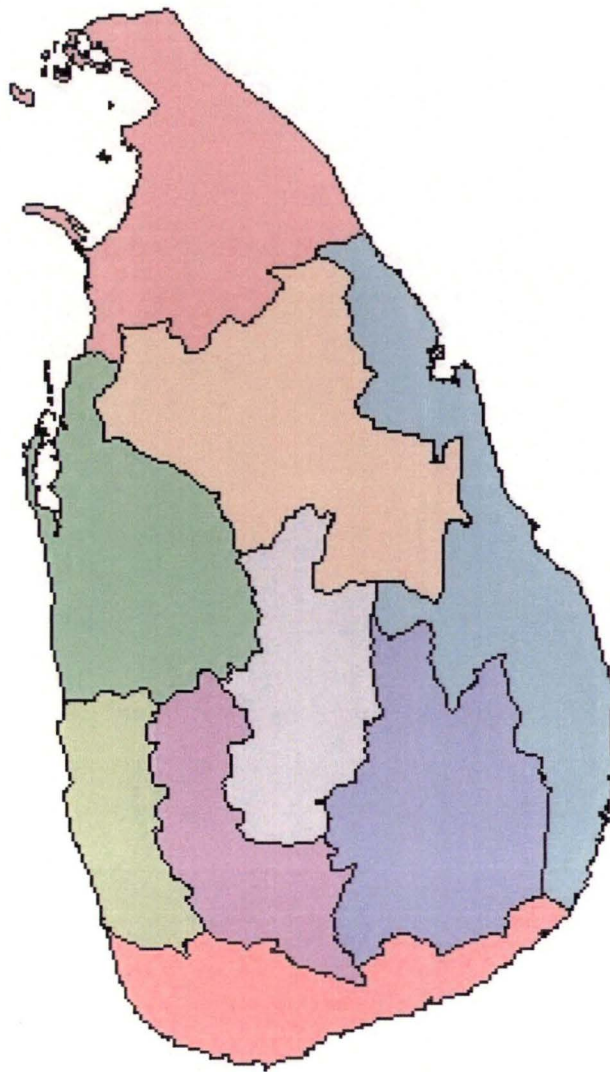


Figure 7: Administrative Provinces of Sri Lanka

	Central Province		Sabaragamuwa Province
	Eastern Province		Southern Province
	North Central Province		Uva Province
	North Western Province		Western Province
	Northern Province		

Source: FAO (2005)
www.fao.org/countryprofiles/map.asp?iso3=LKA&lang=en

economic policy taking into consideration economic goals as well as social and environmental concerns guided by Sri Lanka's Middle Path to Sustainable Development Strategy (MENR, 2002).

Table 1: Some Social and Economic Indicators for Sri Lanka

Social and Economic Indicators	Sri Lanka	South Asia			
GNP (US\$)	820 billion	440 billion			
GNP per capita (US\$)	156	581			
Average annul growth 1993-1999					
Population (%)	1.3	1.9			
Labour force (%)	1.6	2.3			
Poverty (% of population below poverty line)	25	--			
Life expectancy at birth (years)	73	62			
Infant mortality (per 1000 live births)	17	75			
Child malnutrition (% of children under 5)	38	51			
Access to improved water source (% of population)	64	77			
Illiteracy (% of population 15+)	11	46			
Average annual growth	1979-89	1989-99	1998	1999	1999-03
GDP (%)	5.0	5.3	4.7	4.3	5.5
GNP per capita (%)	3.4	4.0	3.4	2.4	3.6
Exports of goods and services (%)	5.5	7.4	1.0	4.0	4.7

Source: World Bank, 2003

Agroecological Farming Systems in Sri Lanka

Sri Lanka is reliant on both irrigated and rainfed agriculture. While irrigated agriculture is synonymous with paddy cultivation and is considered a lowland activity, rainfed agriculture is carried out predominantly in the highlands. The agriculture practised under highland conditions falls into two categories: (1) cultivation without a fallow period such as homegardens / forest gardens and permanent highland farms and (2) cultivation with a fallow period such as systems of shifting cultivation (Abeyratne *et al.*, 1986; Figure 8). Of particular interest to this study is the two systems of rainfed farming in Sri Lanka, namely the shifting cultivation system referred to as chena cultivation (Figure 9) and the homegarden system known as the Kandyan homegardens (Figure 10). Figure 11 shows the areas of permanent cultivation and arable land, while Figure 12 presents a general distribution of farming systems

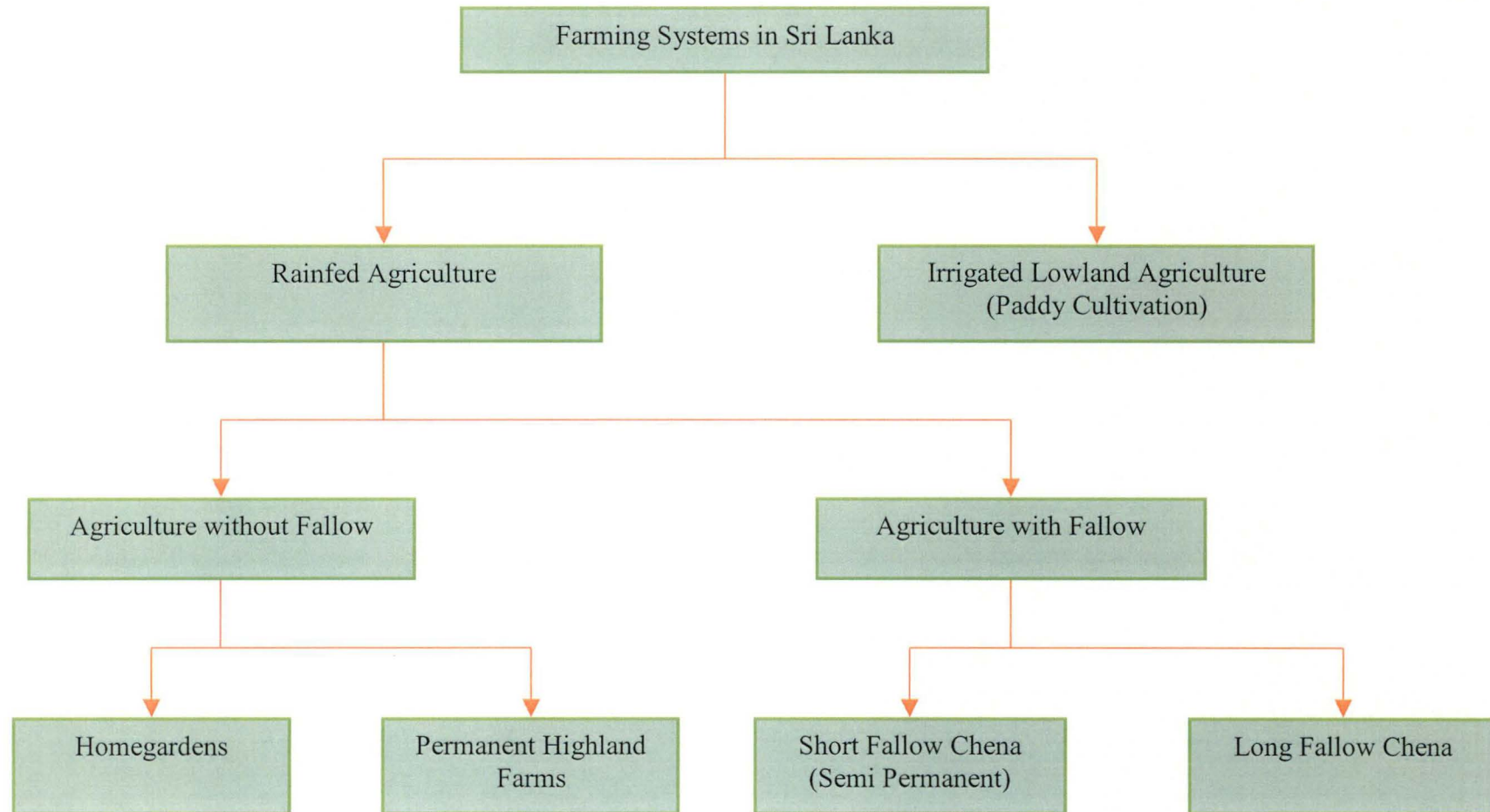


Figure 8: Systems of Land Use in Sri Lanka

Source: Abeyratne *et al.*, 1986



Figure 9: Chena Cultivation

Source: <http://www.horizonlanka.org/village/agriculture/index.htm>



Figure 10: Kandyan Homegarden

Source: Ove Vold, 2004

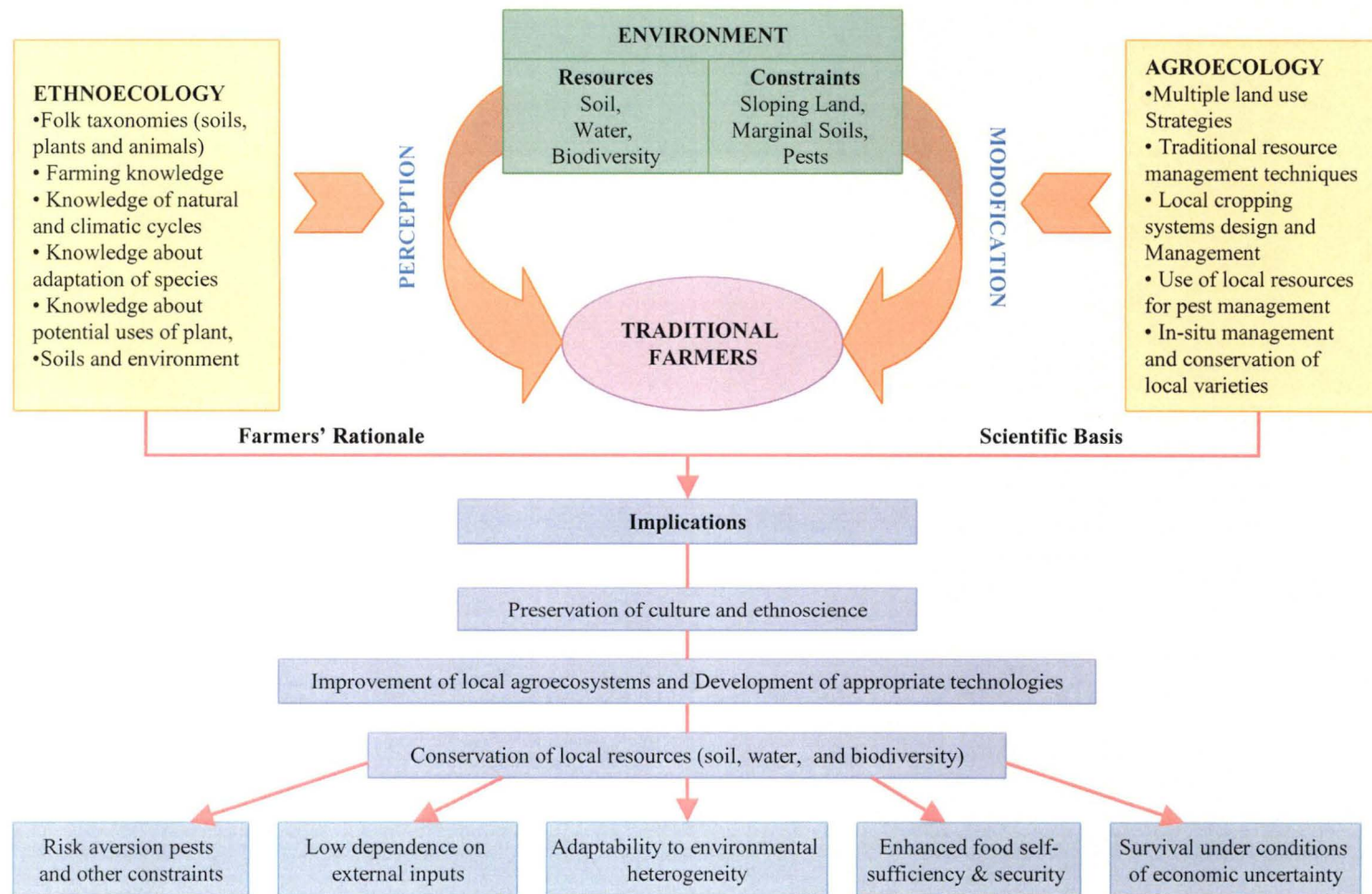


Figure 20: Traditional Farmers' Knowledge and Sustainable Agroecosystems

(Source: Altieri, 2002)

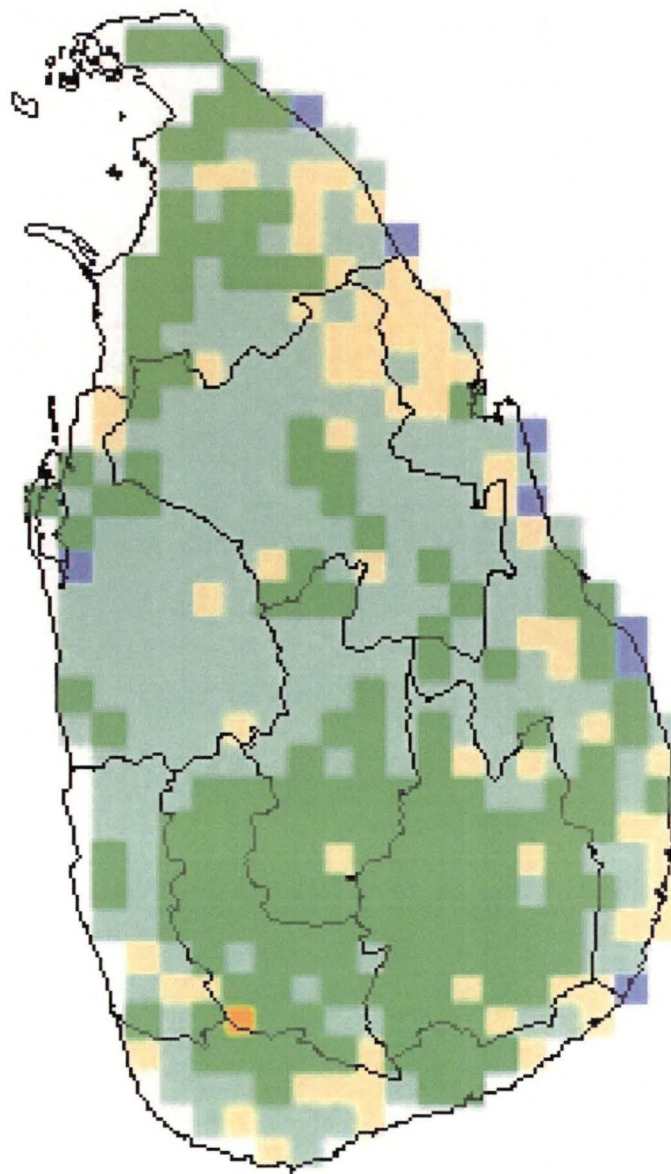


Figure 11: Permanent Crops & Arable Land in Sri Lanka (Percentage Intensity)



Source: FAO (2005)

www.fao.org/countryprofiles/map.asp?iso3=LKA&lang=en

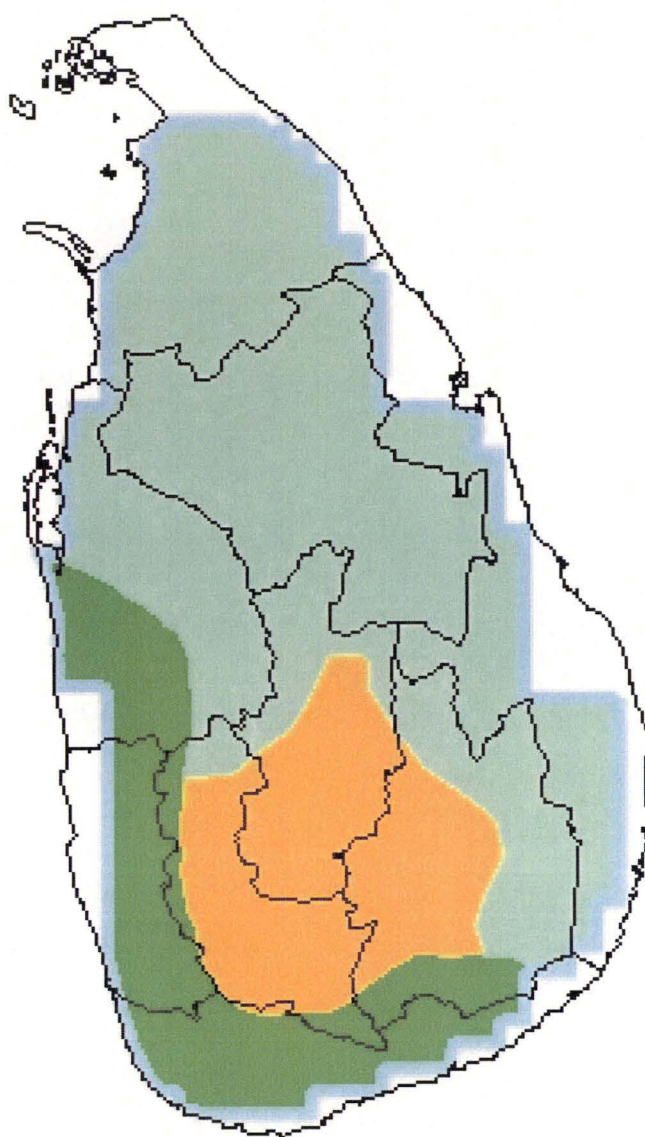


Figure 12: Distribution of Farming Systems in Sri Lanka

- | | |
|---|------------------------------|
|  | 1. Rice |
|  | 2. Coastal artisanal fishing |
|  | 4. Highland mixed |
|  | 5. Rainfed mixed |

Source: FAO (2005)
www.fao.org/countryprofiles/map.asp?iso3=LKA&lang=en

throughout Sri Lanka. The main areas depicted in the illustration are (a) areas predominantly under rice farming; (b) highland mixed farming areas where homegardens and highland farms are commonly found; and (c) rainfed mixed farming areas where shifting cultivation is widely practised.

Although the term ‘homegarden’ is used as a general term in the literature to refer to a wide range of different agroforestry practices, in the classification of homegarden practices in the Sri Lankan context, Abeyratne *et al.* (1986) use the term in a more specific sense. According to this classification, a permanent cultivation (where there is no rotation), with a land size of less than half an acre and containing a permanent dwelling is technically classified as a homegarden. In the case of larger land holdings (more than half an acre) the boundaries of classification tends to blur. In such cases if the farmer owns the land it is then classified as an owned permanent highland farm. In fairly large holdings most often farmers do not own the land. The land belongs to the government and the farmer must obtain a permit to cultivate the land. However, cultivation is often carried out without permits. In most cases, these lands have been under chena cultivation at some point in time but have been transformed into stabilized forms of cultivation due to government restrictions¹⁸. Although farmers may still refer to these as ‘chena farms’, they fall under the category of stabilized highlands farms (Abeyratne *et al.*, 1986).

Shifting Cultivation

The term ‘shifting cultivation’ is used to describe a farming system wherein crops are cultivated for a short phase of time on land that has been cleared and burnt. This short cultivation phase is then followed by a long fallow period (Jordan, 1987). The terms ‘swidden agriculture’ and ‘slash and burn agriculture’ are synonymous with shifting cultivation (*New Agriculturist*, 1995). In fact, Manshard (1979) points out that the literature contains many different terms to denote shifting cultivation or systems of land rotation (Table 2).

¹⁸ A restriction of forest clearing for chena cultivation was brought about by (1) the rapidly increasing rate of land clearance in the 1960s due to population pressure; (2) environmentalists’ position that chena cultivation was damaging to the ecology; and (3) entrepreneurs clearing wide tracts of land for commercialised chena cultivation to grow cereals and pulses which emerged as marketable commodities as a result of import restrictions (Abeyratne, *et.al.*, 1986).

Table 2: Systems of Shifting Cultivation / Land Rotation

Region / Country	Systems of Shifting Cultivation / Land Rotation
Asia: Sri Lanka Indonesia, Malaysia Java Vietnam Thailand Laos Philippines Japan, Korea, Taiwan Myanmar India	<i>chena</i> <i>lading</i> <i>jumah, humah</i> <i>ray</i> <i>tam-ray rai</i> <i>hay</i> <i>hanunoo, caingin</i> <i>karen</i> <i>taungya</i> <i>bewar, dhya, dullee, dippa, erka, jhum, kumri, penda, pothu, podu</i>
Africa: Zaire Madagascar Zimbabwe, Tanzania, Zaire Ghana	<i>masole</i> <i>tavy</i> <i>chitimene, citimene</i> <i>proka</i>
America: Mexico, Central America Guadeloupe Mexico Brazil	<i>milpa</i> <i>ichali</i> <i>coamile</i> <i>roça</i>

Source: Manshard, 1979

The initial stage in this method of cultivation is characterized by the clearing of the forest, secondary bush, woodland or grassland vegetation using simple hand tools. Herbaceous plants, vines and saplings are ‘slashed’ while trees and shrubs deemed as useful are only pruned down. These may be pruned to varying stump heights to facilitate regeneration during the fallow period. In regions where there is a sufficiently long dry period the resulting plant debris is then burnt, while in regions where frequent rain hampers burning, cultivation is carried out without burning. The practice of burning is carried out to repress the sprouting of stumps that would otherwise compete with crops. Large trunks are not consumed in these fire regimes. Only small branches and other debris are eliminated, rendering the land more accessible for planting activities. As a result of burning, seeds of weed species and soil bacteria in the surface soil may also be killed off (Jordan 1987).

In order to sustain productivity within these systems farmers depend largely on organic inputs from the locality, while the use of commercial fertilizers and pesticides is quite rare. While the nutrient-rich ash resulting from fire regimes is considered beneficial for growing crops,

the slow release of nutrients from unburnt decomposing vegetative matter might be even more beneficial for sustaining soil fertility over the usual two to three year cropping period. Polycultures of annual and perennial crops are common as are tree crops. In most instances, almost all the products of shifting cultivation are consumed by the cultivator's family, with a small fraction being traded commercially to obtain various other goods for family needs (Jordan 1987). Labour is the key input in shifting cultivation. Thus labour use efficiency¹⁹ is the main determinant of the system's economic viability (Magcale-Macandog *et al.*, 1998).

The cultivation phase is followed by a much longer fallow period during which the plot is invaded by regenerating successional vegetation. Sometimes trees valued for fruits or wood are planted in abandoned fields that are left to lie fallow. A sufficiently long fallow period is necessary to allow the soil to become replenished for another rotation of crops (Jordan 1987). In one study done on traditional farming systems in Africa, Lagemann (1977) reported that the most important factor in influencing the crop yield was the length of the fallow period. The study showed that the higher the population pressure on land, the lower the crop yield due to shortened fallow periods. Therefore in regions of low population density, shifting cultivation can be ecologically sustainable since long fallow periods allow adequate time for rebuilding of soil nutrients depleted during cultivation and harvesting (Jordan 1987). Yet opinions remain divided about ecological sustainability of shifting cultivation, which has often been associated with high levels of deforestation and loss of biodiversity in the tropics. Despite these unfavourable assumptions that are associated with systems of shifting cultivation, research points to the tenacity and resilience of shifting cultivation. It offers high returns for labour and more importantly, encourages biodiversity and species richness. Studies have shown that traditional systems of shifting cultivation are not necessarily prime causes of forest loss. Other activities such as resource privatisation, land speculation, fiscal incentives for land conversion, tenurial policies and government projects promoting short-term exploitation of the forest under resettlement and transmigration schemes are known to have far more impact on loss of forests. Attempts to alter traditional farming practices have revealed that what is required is a better appreciation of the diverse range of land use types that falls under the umbrella of 'shifting cultivation' (*New Agriculturist*, 1999).

¹⁹ Labour use efficiency is the ratio of food production per labour unit. Labour use efficiency decreases with intensification of cropping (Magcale-Macandog *et al.*, 1998).

Homegardens

According to Nair (2004) the term 'homegarden' is commonly used to refer to a number of practices ranging from growing vegetables in the back garden to complex multi-storied garden systems. This study will focus on the latter. McConnell (2003) uses the term 'forest garden' to describe these agroecosystems and states that classifications such as 'analogue rain forests', 'horti-agriculture', 'agro-horticulture', 'aboriculture', 'compound farms', gardens of complete design' and 'homegardens' are synonymous in meaning. For consistency 'homegarden' is used throughout this work.

Tropical homegardens are known to be among the most sustainable and oldest forms of managed land use systems of farming in tropical agriculture (Kumar and Nair, 2004). They consist of a diverse mixture of trees, shrubs, vines and herbaceous plants. This congregation of multi-purpose annual and perennial plants is usually grown adjacent to a homestead or home compound and is maintained by members of the household. Integration of livestock into the garden is not uncommon. The harvest from the homegarden is mainly for household consumption. The multi-storied composition of crops and perennial trees of the homegardens is typical of many agro-forestry systems and provides sustained yields over time in a resource efficient manner (Nair, 2004).

On average, homegardens are small management units with a high degree of species diversity in cultivated and managed plant communities (Kumar and Nair, 2004). It is not uncommon for homegardens to represent a secondary anthropogenic forest in structure and biomass content (Jensen, 1993). The multi-layered configuration consists of three or four vertical canopy strata. Although homegardens appear to be a haphazard assemblage of plants the arrangement is a purposively structured design with each plant having a specific place and function within the system. They are configured to allow plants to occupy the optimum space available both vertically and horizontally. Characteristically, homegardens comprise a tree layer at the upper levels, a herbaceous plant layer at the ground level, and other intervening layers in between. The lower strata (up to 3 metres in height) consists of various medicinal plants, and food crops such as vegetables, cassava, yam and banana, while the uppermost strata (over 10 metres in height) is composed of fully grown timber and fruit trees. The intermediate level (3-10 meters in height) is mainly composed of various fruit trees. The structure and function of the system always remains dynamic (Nair, 2004).

Although environmental factors are a major consideration, socio-economic factors such as dietary habits and demands of the local market also influence the choice of species in a homegarden (Kumar *et al.*, 1994). The structure of homegardens may range from those meeting subsistence needs through to commercialised enterprises (McConnell, 2003), while the production and management practices depend on the species composition and arrangement of the homegarden (Nair, 2004).

Homegarden systems have largely evolved over time as a response to resource constraints. Population pressures and the consequent reduction in land size and capital and sometimes the remoteness from commercial centres have compelled rural settlers to produce food for most of their subsistence needs. However, it must be noted that homegardens do not usually provide the entire staple food requirement of the family but furnish supplementary food sources (Kumar and Nair, 2004). Any marketable surplus offers a safeguard against crop loss as well as food security during harvesting intervals in other major farming activities that farmers might be engaged in (Nair, 2004).

Agricultural Policy Environment

Over the last two decades small farmers in Asia, Africa and Central and South America have been pressured to convert from traditional polycultural systems to monocultures and export crops since provisions such as credit and extension facilities have often been more readily made available to those who switched to new forms of modernized agriculture. In addition, farmers have been faced with the problem of plummeting prices for traditional crops as a result of cheap subsidized imports from industrial countries flooding the market. As such small farmers have been subject to a systematic process of impoverishment. Hunger and food insecurity remain problems, even though the rationale for public investment in agricultural technology has been to alleviate food scarcity (Kwa, 2001).

Since the 1960s and the 1970s, the World Bank and various research institutions have vigorously supported the adoption of agriculture that is dependent on external inputs -- a technical fix that focused narrowly on increasing yields. Green Revolution agriculture was expected to benefit all farmers, including the poor, since increased yields could translate to increased income. Nevertheless, the heavy dependence on imported inputs could not be

sustained economically by farmers in developing countries. Debt problems during the 1970s and 1980s further compounded the predicament of small farmers. The economic and financial crisis that ensued led governments in developing countries to become increasingly dependent on loan packages from financial institutions (Kwa, 2001). As a result, one of the most significant changes in the policy environment during the past three decades has been the introduction of structural adjustments to promote agricultural output and privatisation schemes (Dixon *et al.*, 2001). Since the 1980s about 100 national governments have been compelled to accommodate these structural adjustment packages as a condition for the loan packages obtained by these countries. Structural adjustment policies forced liberalised trade and exchange rate regimes as well as the conversion of domestic agriculture for the export market (Kwa, 2001). More recent international agreements and the establishment of the World Trade Organization have further promoted trade liberalization (Dixon *et al.*, 2001).

Food security is a dominant policy issue for developing nations and a key element within their rural sector policies. Among policy makers there has been a growing interest in the potential to increase the efficiency of service delivery through institutional restructuring processes such as (a) the transfer of public sector roles to the private sector and the community; (b) the decentralization of services; and (c) restricted government investment in public goods (Dixon *et al.*, 2001). This trend towards 'efficiency' has encouraged more local level and private sector participation in resource allocation and management, a pattern expected to continue. Non-governmental resources have been mobilized and partnerships with local communities have been more responsive in addressing local needs. However, in many countries community and private sector institutions have had difficulties effectively replacing services provided by public sector institutions, especially in impoverished rural areas. As a result, farmers of small-holdings and female-headed households have been particularly affected by the weaknesses in service delivery. In some countries however, these decentralisation and democratisation processes have considerably strengthened local institutions, while the role of women in local governance has also become more and more visible (Dixon *et al.*, 2001).

Another challenge to policy which will become increasingly pronounced over the next few decades is access to and control of natural resources such as land and water. It is also expected that population pressures on the resource base will heighten marginalized communities' demands for more equitable rights to resources. While urbanization might spatially relocate some of this burden, analysts point out that governments which are unable to

reform their policy frameworks for more equitable resource allocation and management measures could encounter serious social conflict (Dixon *et al.*, 2001).

Policy frameworks that enable sustainable agriculture are missing in many countries. Most policy frameworks promote agriculture that is dependent on external inputs and technologies, but despite this orientation traditional forms of agriculture which rely on local knowledge and inputs have persisted in many places because of community efforts (Pretty, 1995). If research that suggests that traditional systems are often more sustainable than industrialized and modernized systems is correct then policy reforms that encourage the former is warranted.

Although the need for a supportive policy environment for sustainable agriculture has been widely acknowledged by many analysts, in reality the efforts taken in this direction remains sketchy and inconsistent. There are a few examples however, of countries where explicit policy directives for sustainable agriculture are central to the national agricultural policy framework. These include Cuba which has established a national policy for development of alternative agriculture; Switzerland which has policies in place to promote environmental services from agricultural and rural development activities; and Bhutan which has a coordinated environmental policy cross-cutting all sectors (Pretty, 2004). However, in most countries reforms in agricultural policies are partial or rudimentary. They exist in fragmentary form in relation to new regulations, incentives, environmental taxes and administrative mechanisms but appear to have had considerable positive impact (Pretty and Hine, 2001).

Sri Lanka's Agriculture Sector and Policy Overview

As with the trend in most middle-income countries, Sri Lanka's agricultural sector's share in the gross domestic product (GDP) declined from 28 per cent in the 1980s to 20 per cent in 2000. The proportional contribution of Sri Lanka's agriculture sector to the GDP has dropped so drastically that it is now the second lowest in the South Asian region. The migration from agricultural labour to the industrial and service sectors is a continuing trend. Although there has been a notable decline in the economic importance of agriculture in the country a large number of rural households (usually the poorest) remain heavily dependent on income derived from agricultural activities. About 45 per cent of rural households, half of which fall into the bottom 40 per cent of the expenditure quintiles, are households dependent on agriculture

(World Bank, 2003). In some provinces income from agriculture remains crucial as indicated by the percentage of income the province derives from agriculture and the percentage of agricultural households in the province (Table 3).

Table 3: Income from Agriculture and Agricultural Households

Province	Income from agriculture (% of the income of the province)	Agricultural households (% of the rural households in the province)
North Eastern Province	67	53
Sabaragamuwa Province	60	50
Uva Province	59	76
Southern Province	48	no data
Central	47	no data
North Central	no data	83

Source: World Bank, 2003

To place the agricultural sector on a trajectory of higher growth Sri Lanka has adopted several policy measures aimed to shift it from low value to high value production. Dating from 1996, these measures have been meant to improve productivity and international competitiveness. The expected level of growth in the agriculture sector is yet to materialize despite the fact that the Sri Lankan government assented to a national water policy in 2000; a national seed policy in 1996; liberalization of land markets; granting farmers full ownership rights to land which was completed by 2002; privatised seed farms; and subsidized credit programs, to limited effect on productivity. This composite failure might be attributed to other, more powerful policy frameworks. These include unstable trade policies; restrictive quarantine regulations; delays in seed and phyto-sanitary regulations; commodity price interventions; limiting land policies; and inefficient water delivery systems. It is reported that the result has been increased operating costs; reduction in productivity and profitability; declined competitiveness; and higher market risks for the agriculture sector (World Bank, 2003).

The weak performance of the agriculture sector in Sri Lanka has also been attributed to the absence of a long-term strategy for agriculture that compliments overall rural development goals (World Bank, 2003). Although each Ministry is expected to formulate policies covering

the sectors that it governs in line with the Agenda 21 principles²⁰, at present there is no explicit long-term policy for the agriculture sector (MENR, 2002; World Bank, 2003). As such, at the time of this research no comprehensive policy document could be found.

However, it is worthwhile to note some of the existing strategies for agriculture relevant to Sri Lanka's Middle Path to Sustainable Development²¹. Modernization appears to be a key strategy here. In terms of social and economic development, one of the explicitly stated strategies for the agriculture sector is to transform subsistence agriculture into high-income generating enterprises. Since chena and the Kandyan homegardens fall under the category of subsistence agriculture, this policy directive will have significant implications for these two farming systems. Likewise, another strategy is to establish intensive diversification of agricultural products from traditional plantation sector export crops to technology based agrobusiness enterprises -- one means to rejuvenate the rural economy via technology improvements in agriculture. This strategy is in line with the goal to shift the rural poor from low productivity subsistence agriculture to modernized agriculture as well as high productivity services and industry. Modernization of the agriculture sector through mechanized farming, promotion of high productivity per unit area, support for organic farming, as well as institutional reforms for improved private-public partnerships are other strategies recommended for the agriculture sector. The strategy to ensure food security by diversifying indigenous food sources is also highlighted (MENR, 2002). Figure 13 shows levels of food insecurity distributed throughout Sri Lanka.

According to the Sri Lanka's Middle Path to Sustainable Development framework it is acknowledged that natural resources are to be managed in an ecologically and socially sustainable manner. Environmental management and protection strategies that will have a bearing on the agriculture sector include: finalization of land policy; formulation of relevant legislation for protection of biodiversity; prevention of ecosystems fragmentation (one means of abating the man-elephant conflict in rural areas); and promotion of organic agriculture. In addition policies to enhance the participation of major groups will include measures such as utilization of traditional knowledge where appropriate; capacity building of farmer

²⁰ The Sri Lankan government has adopted Agenda 21 as a blueprint for sustainable development goals (MENR, 2002).

²¹ Sri Lanka's Middle Path to Sustainable development is based on achieving balanced growth in three major policy areas: economic, social and environment (MENR, 2002).

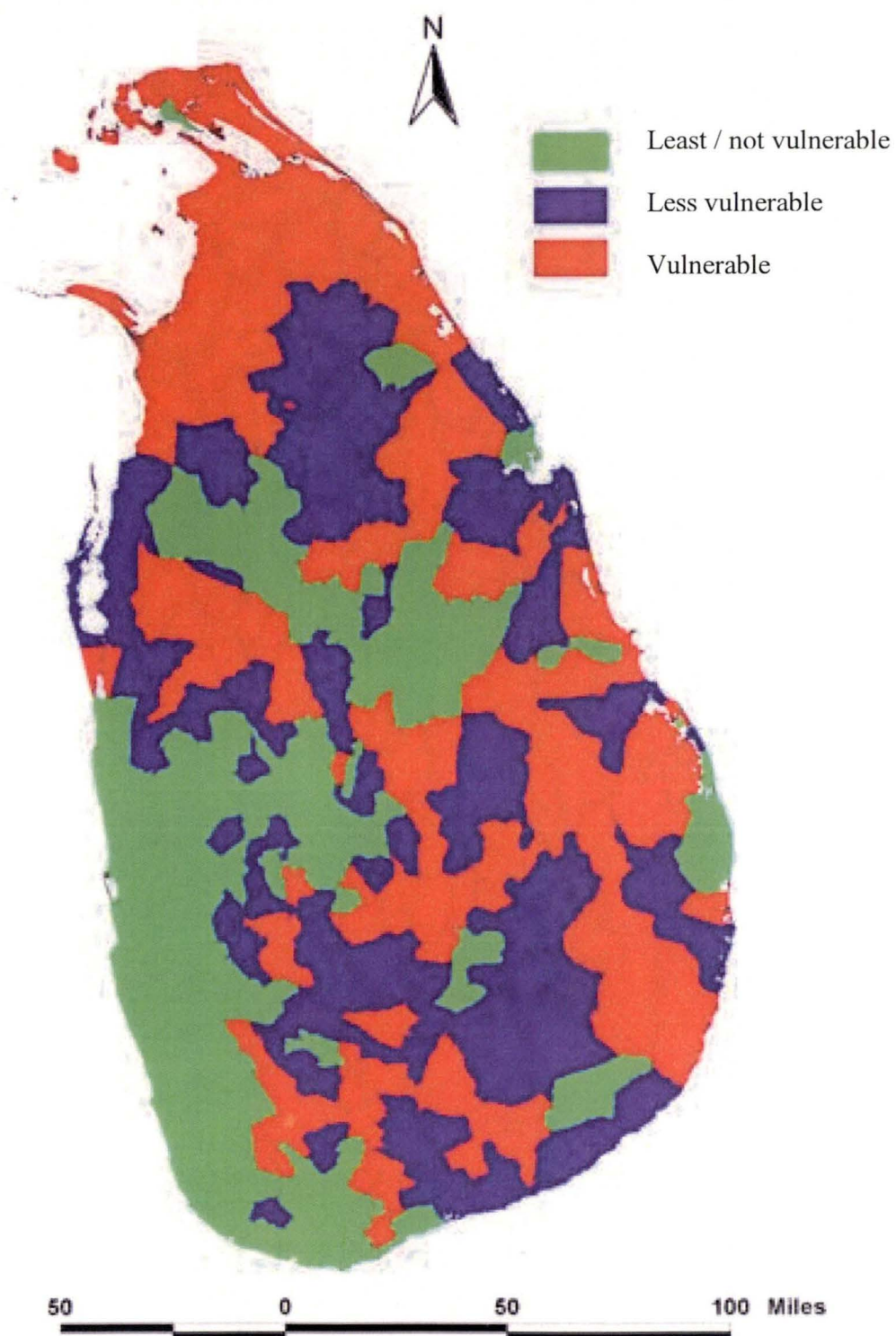


Figure 13: Food Security in Sri Lanka

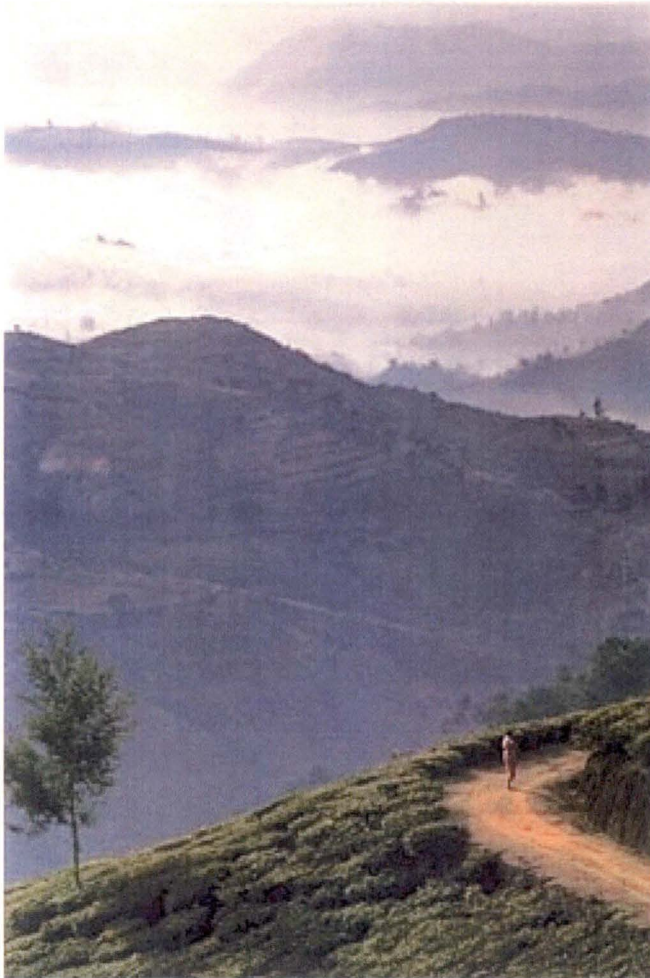
Source: FAO (2005)
www.fao.org/countryprofiles/map.asp?iso3=LKA&lang=en

organizations; and strengthening of linkages between the scientific community and the decision makers (MENR, 2002).

Summary

Feeding an increasing population in a 'sustainable' manner while preserving and enhancing the natural resource base appears to be a tremendous challenge. Addressing issues of food security and environmental degradation are key issues for most developing nations. But the capacity of modernized farming systems to alleviate 'food poverty' of resource poor farmers working in marginal environments is held in question as conventional western technologies are designed on the basis of much different environmental and socio-economic circumstances. Some scientists view the convergence of traditional farming systems with scientific understanding and advances or the *agroecological* approach as the key to feeding the world's poor who depend on fragile and vulnerable agroecosystems. Although traditional / indigenous agricultural systems are referred to as agroecological systems the term 'agroecology' is now frequently used to describe any agronomic system that emphasizes ecological considerations as well as socio-economic needs. Taking these various points on board, this study is concerned with two forms of agroecological farming systems in Sri Lanka that are commonly practised alongside irrigated agriculture.

It has been noted by analysts that an enabling policy framework for sustainable agriculture is missing in most countries. Most policy frameworks promote modernized agriculture that is dependant on external inputs and technologies. Similarly, the Sri Lankan agricultural policy framework in general supports an agricultural paradigm to transform the subsistence agriculture sector into modernized, high-income agro-business enterprises. Strategies for promotion of biodiversity; prevention of ecosystems fragmentation; utilization of traditional knowledge where appropriate; support for organic farming; improved private-public partnerships; and capacity building of farmer organizations also have implications for subsistence agriculture in Sri Lanka.



Chapter 3

Respondents' Perceptions on Sustainable Agriculture

Photo: Luke Powell, 1996



Photo: Dominic Sansoni, 2002



CHAPTER 3

Respondents' Perceptions of Sustainable Agriculture

In what follows, I document respondents' perceptions of sustainable agriculture in general as well as in relation to the situation in Sri Lanka. The constructivist view of participation in the construction of knowledge -- namely that meaning is *created* based on personal and social realities rather than *discovered* (Raskin, 2002; Sexton, 1997) -- inspired me to examine how respondents created their own meanings of the ambiguous concept of sustainable agriculture because, as Sexton (1997, 8) elaborates,

The perspective of the observer and the object of observation are inseparable; the nature of meaning is relative; phenomena are context-based; and the process of knowledge and understanding is social, inductive, hermeneutical, and qualitative.

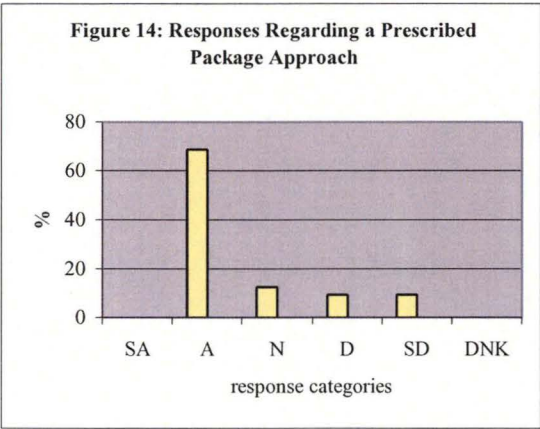
A recurring theme in respondents' descriptions of sustainable agriculture is the frequent reference to *agricultural practices*. One of the central tenets of sustainability is the need to protect the basic rights of future generations. With the recognition that human activity can have long lasting and potentially damaging effects on the environment, the importance of adopting agricultural practices that enable the long-term use of resources and ensuring the rights of future generations emerged as a theme. Sustainable agriculture is perceived as a set of practices that '*maintains resources for the benefit of the future generations*' (RA1) and that it '*maintains resources long-term*' (RA7). It is '*a farming system which can provide long-term sustenance*' (RA25). Ideas about efficient resource use and waste minimization also hint at a need to *stretch* the use of resources over time. A few respondents emphasized intensification as an important consideration in defining sustainable agriculture. Intensive agriculture is a form of subsistence agriculture practised by the members of populous societies in order to produce more food per acre in a much larger scale in comparison to other types of subsistence agriculture (O'Neil, 2004). Similarly, intensive agriculture can also be understood as comprising farming systems based on short fallow periods or a permanent form of agriculture where various labour intensive practices (composting, manuring, irrigation) are employed (Widgren, 2004). Intensification -- as in '*cultivation that can be maintained uninterruptedly*' or (RA2) '*when farming is done every planting season and in between*

seasons' (RA23) --implies drastically shortened intervals between planting seasons, perhaps requiring intensified management practices to maintain continuity. Some respondents have noted that such practices are necessary for sustainable agriculture. However, there appears to be no concrete evidence to support this claim because Widgren, (2004) points out that the argument that intensive agriculture represents sustainable farming is based mainly on historical reasoning rather than on ecological modelling. Similarly, observations such as '*integrated farming systems, integrated pest management, [and] integrated plant nutrition—all these combined can create sustainable agriculture*' (RA18) suggest an inclination towards holism -- where sustainable farming systems encompass the forms, dynamics and functions of all constituents within them (Reijntjes *et al.*, 1992).

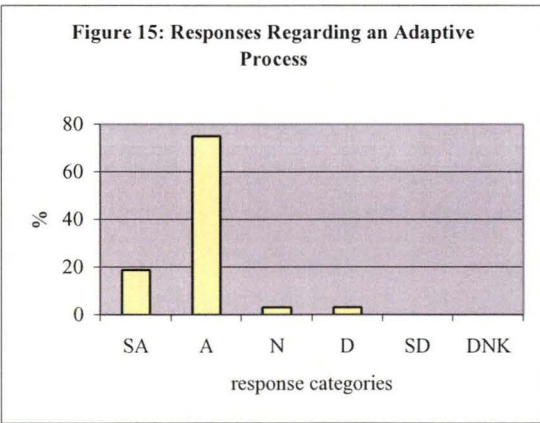
Defining sustainable agriculture in terms of *environmental effects* also emerged as a crucial theme among respondents. There is emphasis on non-damaging or non-disruptive effects: '*the ecosystem should be affected in the least possible manner*' (RA13); '*does not harm the environment or biodiversity*' (RA23); '*minimum disturbance to the natural system*' (RA30); and '*without harming the environment or biodiversity*' (RA19). Socio-economic elements are also infused into definitions of sustainable agriculture, and emphasize the necessity to balance productivity with environmental protection (RA30). This view aligns with the generally accepted need to advance the dialogue between ecological and economic perspectives in order to arrive at an economic model that is ecologically sustainable (Holdgate, 1997).

Another prominent theme that emerged from the analysis related to perceptions about *institutional weaknesses*, not least of which were observations about the lack of sound policy. The claim that '*there is no national program for sustainable agriculture*' (RA6) suggests that the existing policy may not be geared for sustainable agriculture. Another, that '*farmers should not comply with the government*' (RA22), indicates that people within the system may in fact think that government policies are not appropriate. The indifferent utility of the policy framework is echoed in the observation that sustainable agriculture is '*practised by farmers without any support from the government or any other service*' (RA29) which implies that sustainable agriculture relies on farmers' knowledge, experience and available local resources, instead of what is provided through an external source, in this case the government and other support services. As Altieri (2002) points out, most subsistence farmers live in highly heterogeneous and risk-prone environments. As modernized farming techniques have evolved under entirely different set of environmental and socio-economic circumstances

subsistence farmers benefit little from modern agriculture technologies. Therefore, farming systems reliant on indigenous knowledge and local resources are well adapted to the needs of subsistence farmers and the peculiarities of the terrain in which they live. The statement also implies that the persistence of sustainable practices is due to the efforts of farmers rather more than to institutional structures.



prescribed as a uniform package about 69 per cent of the respondents to Questionnaire A¹ agreed (Figure 14) and, conversely, when asked whether sustainable agriculture should be promoted as a process to learn and adapt, an overwhelming 94 per cent of the respondents to



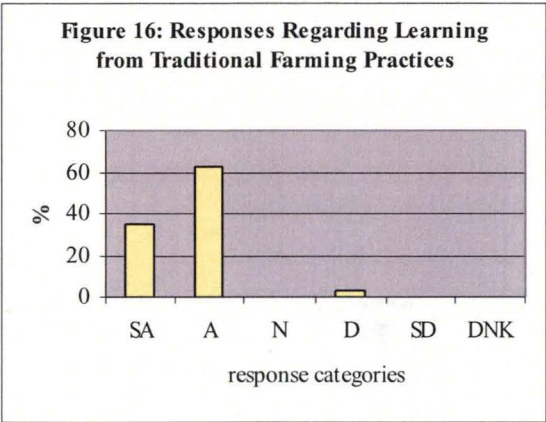
Sustainable agriculture does not entail a prescribed set of practices (SARE, 2003). It is an adaptive process (Pretty, 1995). Since small farmers in Sri Lanka work under diverse conditions, an adaptive process to suit these heterogeneous conditions appears to be especially appropriate instead of a standardized package of technology. However, when asked whether sustainable agriculture should be

prescribed as a uniform package about 69 per cent of the respondents to Questionnaire A either agreed (75 per cent) or strongly agreed (19 per cent) (Figure 15). There is high level of support for both approaches, which leads to opposing views that sustainable agriculture practices can be standardized into a rigid set of prescriptions and also be flexible practices that are adapted to site-specific conditions. This outcome raises

questions about whether sustainable agriculture is generally perceived by respondents as something which has both fixed and fluid attributes. The majority of responses advocating a prescriptive approach pointed to a need for farmer training, while responses favouring an adaptive approach stressed the need to recognize the validity of farmers' knowledge and experience. When these deeper reasons for the foregoing approaches are juxtaposed the initial conflict between the two concepts becomes less obvious -- that is farmer training and

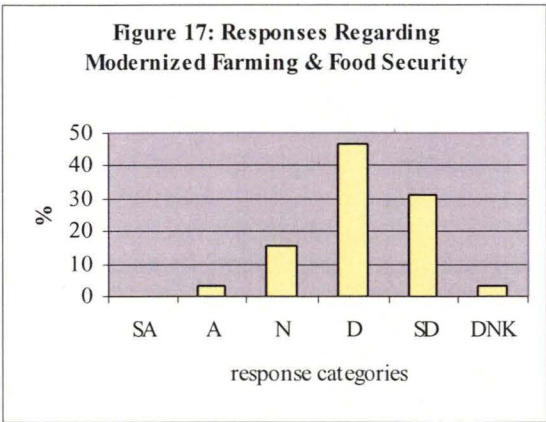
¹ The Likert scale responses included in Questionnaire A is as follows: SA= strongly agree; A= agree; N= neutral; D= disagree; SD= strongly disagree; and DNK=do not know. These are presented as response categories in all the graphs illustrating the research participants' responses in Chapter 3 through to Chapter 5.

extension is perceived as an important institutional responsibility hence the need to ‘prescribe’ while at the same time recognizing the possible contribution of farmers’ knowledge and experience to the process resulting in ‘adaptive’ practices. In fact, it is possible that within the institutional structure both processes are viewed as being complimentary rather than being contradictory.



It is evident that the majority of the respondents perceive traditional systems as a valuable reservoir of knowledge. Almost 97 per cent of the respondents to Questionnaire A either agreed (62 per cent) or strongly agreed (35 per cent) that much can be learnt from traditional farming systems and via the knowledge and the experience of traditional

farmers (Figure 16). It has been argued that traditional farming systems provide models of sustainability for developing locally adaptive, complex farming systems for resource poor farmers (Denevan, 1995). These systems are seen as environmentally beneficial in observations such as: ‘good way to protect the country’s natural resources’ (RA1); ‘beneficial for the protection of the ecosystem’ (RA4); and ‘traditional practices are sustainable’ (RA9). Some reference was also made by respondents to the socio-economic benefits of traditional agriculture as contributing to food security, lessening health risks and reducing farm costs.

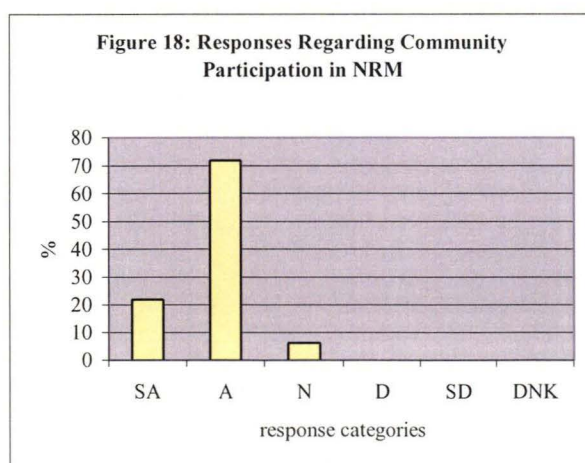


When asked whether modern agriculture can be considered the only answer to food security, about 78 per cent of the respondents to Questionnaire A either disagreed (47 per cent) or strongly disagreed (31 per cent) (Figure 17). From among these, a cross section of responses revealed that respondents perceived modern farming systems as lacking advantages that

they identified in traditional systems such as food security, cost effectiveness and lower health risks. Observations that indicate the disenchantment with modern agriculture is illustrated by responses such as ‘modern agriculture does not incorporate the concept of food security’

(RA3); ‘does not provide food security to resource poor farmers’ (RA12); ‘in times of food shortage, modern agriculture is not helpful’ (RA5); ‘it is too commercialised’ (RA7); ‘modern agriculture is driven by profits’ (RA14); and ‘not suitable for this country’ (RA8). There seems to be significant agreement that food security and commercial ends are dissonant goals especially in the context of subsistent rural communities. Other reasons for being critical of modern agriculture included concern over the use of agrochemicals: ‘the use of poisonous agro-chemicals is widespread’ (RA28); ‘too many pesticides are being used with adverse effects’ (RA25); and ‘chemicals used in modern agriculture are detrimental to health’ (RA1). While the general attitude is quite antipathetic to an agricultural model based on purely modern approaches there are those who propose a *hybrid* approach between modern and traditional methods. This model is not inconsistent with an *agroecological approach*, where risk reducing and resource-conserving traditional farming methods are unified with scientific methods to create an ecologically sound agricultural model suited for the needs of small farmers, farming in harsh and marginal environments (Altieri 2002; Dover and Talbot, 1988).

Holdgate (1997) points out that people’s beliefs, values, and the knowledge and understanding of how to manage natural resources in a sustainable manner are essential elements that determine the type of action that takes place within communities. If decisions within these communities are to be put into effect in order to achieve sustainable living then communities must be structured and empowered to take part in decision making processes, that are normally the province of policy makers. Communities can be empowered through actions that enable them to exercise greater individual control over their own lives; meet their



needs sustainably; and participate in resource conservation. An exploration of respondents’ attitudes to community participation in resource management revealed that 94 per cent of the respondents to Questionnaire A either agreed (72 per cent) or strongly agreed (22 per cent) that it is beneficial to work with community groups in managing resources (Figure 18).

It was widely recognized that ‘local groups have a good understanding of local resources and needs’ (RA7) and that ‘they can contribute based on their knowledge and experience’

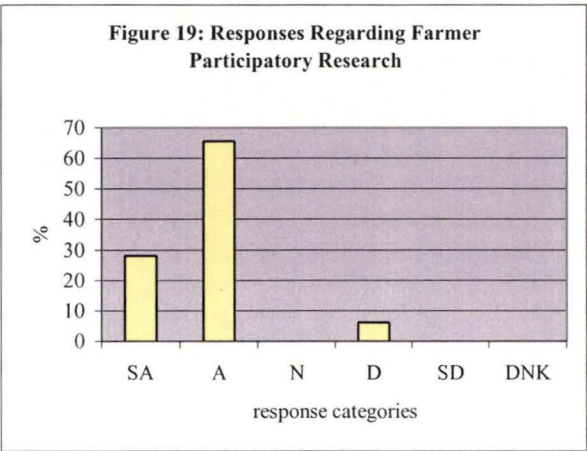
(RA14). In any case, it was reasoned that resource management must be a communal effort since resources are communally owned and therefore need to be managed as such (RA13, RA31). The idea that resources management should not be done in isolation, as each resource is linked to other resources (RA17), suggests a preference for an integrated approach in decision making and management of natural resources. The Global Environment Facility (2000) makes the observation that in many countries, past attempts to address resource management issues on a case-by-case basis, have led to fragmentary policies, institutions and interventions. The desired level of success was not achieved, since the linkages between natural systems as well as interactions within social systems were not recognized. Therefore natural resource management requires systems, which are compendious and cross-sectoral in approach. One such useful system is an integrated ecosystems approach where management is extended beyond the confines of a single habitat, conservation area or administrative division to embrace the entire ecosystem.

The need to empower communities in making decisions that affect them has also been expressed as follows: '*community groups should be involved in decision making*' (RA10); and '*in the process of decision making and management, ideas of local groups and organizations should be considered*' (RA17). It has also been noted that '*in certain areas local resources are traditionally owned by local groups*' (RA13). When there are communally owned resources, it is necessary to have systems in place that allow consensual and equitable allocation and management of such resources. In order to empower communities to exercise greater control over these localized resources, the decentralization of power and the reinforcement of local institutions must be achieved (Holdgate, 1997).

Observations such as '*there are results when the community is involved*' (RA9) and '*there is a lot of benefit in working with local groups*' (RA30) indicate that community involvement may be advantageous in getting the job done and that it eventually leads to better outcomes in resources management. Howitt (2001, 314) describes a similar phenomenon in resource management where diversity and differences provide the basis for accomplishing improved outcomes in resource management. He asserts that recognition of diversity and differences and the deliberative responses to these creates 'more, just, equitable and sustainable outcomes that are more tolerant of human diversity'.

Still on the subject of participatory methods, it is also interesting to note the current trends in farming systems research. Robinson *et al.* (2001, no page) say of the unfolding trends in farming systems research:

Due to the social and applied nature of farming systems, there has always been a need for holistic methods and emphasis on the role of farmers in farming systems research. The ‘soft systems’ approaches involve a fundamental belief that people and their behaviour are central to agricultural development, which is a contrast to the ‘hard systems’ methods that provide objective technical solutions.



Approximately 83 per cent of the respondents to Questionnaire A agreed (28 per cent) or strongly agreed (66 per cent) that they favoured the ‘soft systems’ approach to generating knowledge or, in other words, would encourage farmers’ participation in research and experimentation (Figure 19). Technology transfer based on a top-down approach is no

longer seen as an appropriate model in extension and more participatory approaches have gained wider acceptance (Clayton *et al.*, 1997; Ison and Russel, 1999). Participatory approaches are considered a crucial element in sustainable development especially in highly heterogeneous environmental and socio-economic situations (Roling and Wagemakers, 1998). They are founded on principles such as an appreciation of local knowledge; non-coerced social change; recognition of the participants’ ownership of research outcomes; action based on the learning that occurs from research; inclusion of participants at every stage of research process; and inclusiveness of marginalized groups (Clayton *et al.*, 1997). Therefore, it is not unusual to find that commonly cited reasons by the respondents for favouring a participatory research approach is that ‘it [participation] gives them ownership’ (RA3); ‘participation is necessary if they [farmers] are to feel ownership and acknowledge results’ (RA4); and ‘it [participation] provides better credibility’(RA28). These views invariably imply that improved credibility of research findings leads to higher level of technology adaptation by the farmer.

A recurring theme in the data was reference to farmers' knowledge and experience as being significant to research and experimentation. Respondents stated that '*they [farmers] have gained their knowledge through years of experience and practice. Their experience and knowledge should be made use of*' (RA17); '*not only scientists, [but] traditional farmers also have good technical methods*' (RA18); '*farmers have very practical ideas*' (RA20); and '*their [farmers'] experience can be quite useful*' (RA23). This sort of view is indicative that *local knowledge* is perceived to play a significant role in knowledge and technology generation.

UNESCO (2003, no page) describes local knowledge, sometimes referred to as indigenous knowledge systems, as

the cumulative and complex bodies of knowledge, know-how, practices and representations that are maintained and developed by peoples with extended histories of interactions with the natural environment.

This accumulated knowledge is usually part of a complex cognisance that also encompasses language, attachment to place, spirituality, and worldview. This body of knowledge may be known by a multitude of terms such as traditional ecological knowledge (TEK), indigenous knowledge (IK), local knowledge, rural peoples'/ farmers' knowledge, ethnobiology / ethnobotany / ethnozoology, ethnoscience, folk science and indigenous science. This multiplicity of terms arises from the fact that a single term is not sufficient to describe the diversity of social, political and scientific contexts (UNESCO, 2003). It should also be understood that in many cultures the boundaries between the 'rational' or 'objective' remains rather indistinct from the 'sacred' and the 'intuitive'. Similarly 'nature' and 'culture' are not antithetic nor are they confined by definite boundaries. Within this setting all components of traditional knowledge, practice and representations remain interwoven and coactive (UNESCO, 2003).

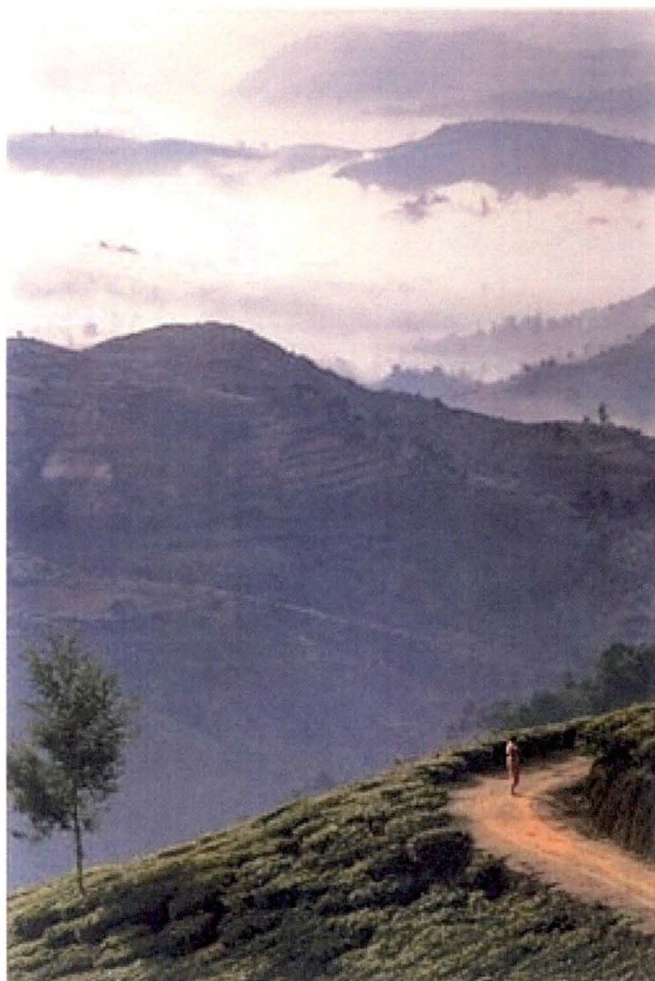
Another reason given for the preference of farmer participatory research was that there was too much delay in research findings reaching the farmer as in observations such as '*most research and experimentation results reach farmers rather late*' (RA3); '*research and experimentation [results] reach farmers too late*' (RA6, RA14); and '*farmers will benefit if results of research and experimentation reach them faster*' (RA13). These views undoubtedly indicate a gap in the research and extension machinery, and suggest that field level

participatory research carried out involving farmers is seen as being able to provide more immediate and undelayed solutions.

Summary

Sustainable agriculture is perceived by survey respondents as an environmentally benign and a socially acceptable approach to agriculture. The respondents' definitions of sustainable agriculture reflected several major themes such as *agricultural practices*, *environmental effects*, and *institutional weaknesses*. Practices that ensure the 'resources use rights' of future generations, intensified farming practices, integration and holistic approaches were considered to lead to sustainable agriculture. In terms of environmental effects, agriculture which is non-damaging and non-disruptive to the ecosystem and at the same time able to meet human goals was emphasized as defining characteristics of the sustainable agriculture paradigm. Based on the respondents' views the present institutional framework appears as lacking a sustainable agriculture bias while the persistence of sustainable agriculture is considered as a result of largely farmers efforts.

Respondents appear to perceive sustainable agriculture as having both fixed and fluid attributes -- a prescriptive approach that emphasizes top-down training and an adaptive approach, which emphasizes farmers' experience and knowledge. It is possible that these processes are perceived not as contradictory but as complimentary. While there is a high level of recognition regarding the benefits of farmers' knowledge, experience and traditional farming practices there is a certain degree of disenchantment regarding purely modernized farming. A hybrid model between traditional and modern practices is favoured by the respondents. Respondents' views on sustainable agriculture also favoured community participation in resource management and participatory research indicating that community empowerment is acknowledged as being a necessary element in agricultural development. From an institutional aspect this position could indicate an openness to disrupt or dissolve power structures between administrators and the farming communities.



Chapter 4

Respondents' Perceptions on Agroecological Production Systems

Photo: Luke Powell, 1996

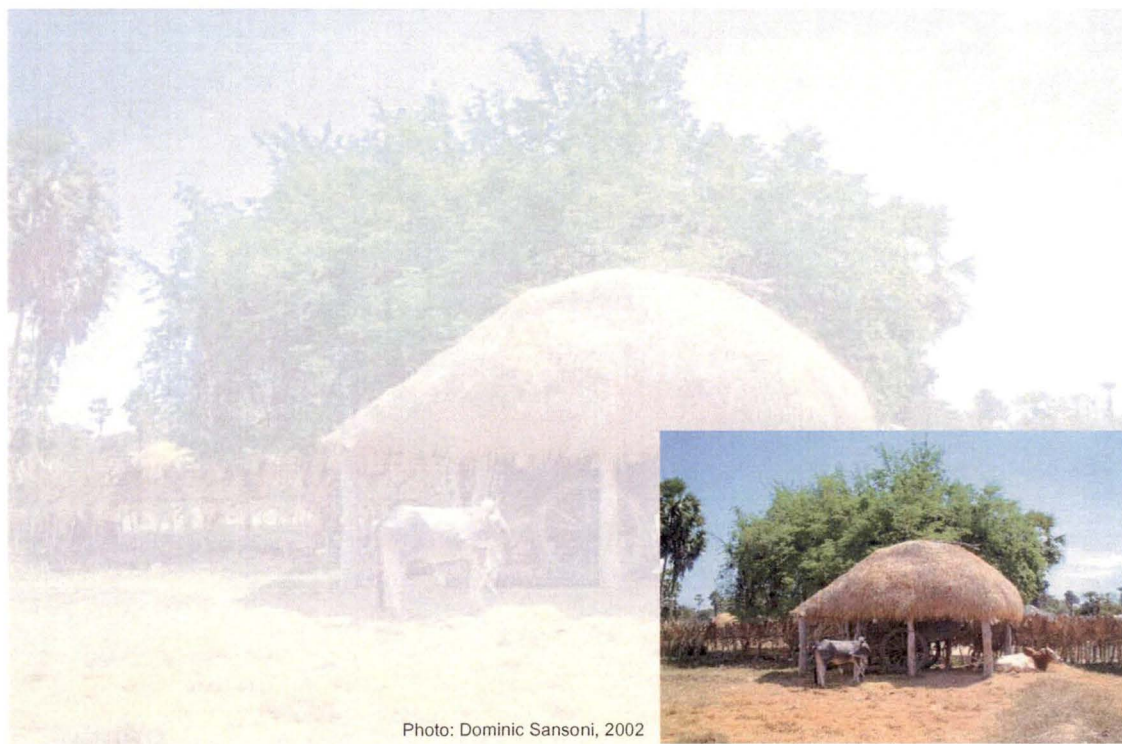


Photo: Dominic Sansoni, 2002

CHAPTER 4

Respondents' Perceptions on Agroecological Production Systems

The purpose of this chapter is to explore respondents' views on some principles and processes commonly practised within agroecological farming systems. Here, I outline some of the salient themes that emerged in this exploration.

There is growing recognition that indigenous forms of intercropping, agroforestry and other traditional farming systems are designed to mimic ecological processes and natural systems. The sustainability of these systems has been attributed to the ecological models that they imitate (Reijntjes *et al.*, 1992). Unmistakably, the old systems have served as prototypes for the emergent paradigm of *agroecology*. Historically, however, resource-conserving and risk-reducing traditional systems have been spurned as 'primitive' by the advocates of conventional agriculture with their strong biases against the knowledge of local and indigenous societies. In fact, such biases have done much to deprecate and obscure these traditional systems. Hecht (1995) identifies several factors responsible for the near obliteration of traditional agronomic systems. These include (a) dramatic conversion of many non-western indigenous societies and production systems due to colonialism¹, market forces, demographic collapse and slaving; (b) disruption of the means to encode, regulate and transmit agricultural practices; and (c) the influence of positivist science².

Agroecological systems are re-emerging and there is renewed scientific interest in this field. Although many traditional systems have disappeared, millions of hectares under traditional farming systems doggedly persist in developing regions. This persistence attests to the success and ingenuity of indigenous agricultural strategies adopted by small farmers. Usually these systems encompass a high degree of biodiversity in the form of polycultures and agroforestry systems -- a strategy which minimizes risks of crop failure and provides dietary variety. These systems help resource poor farmers to survive under harsh environmental conditions and to meet their subsistence needs without having to rely on chemical fertilizers, pesticides,

¹ Agricultural economies founded on traditional production systems were transformed into export oriented cash cropping economies to cater to the needs of colonial bureaucratic regimes (Hecht, 1995).

² The epistemological shift in viewing the natural world as atomistic and mechanistic in the 18th century dismissed other forms of knowledge as being superstitious including that of indigenous people often denigrating their abilities and knowledge (Hecht, 1995).

mechanization and other modern technologies which might in any case be out of their reach (Altieri, 2002). They are usually sophisticated forms of ecological agriculture which integrate different land use functions³ together with various biological components⁴ thereby increasing farm stability and productivity while conserving the natural resource base (Reijntjes *et al*, 1992). Figure 20 illustrates how traditional farmers interact with their resource base and the implications this has for developing sustainable agroecosystems.

In conventional agriculture, it is assumed that farm production can be understood separately from the surrounding agroecosystem, the farmers and the social fabric in which the farmers live. Conventional agriculture seeks solutions through controlled laboratory experiments and experimental plots in field stations as if agriculture exists in a vacuum (Norgaard and Sikor, 1995). What is often overlooked in conventional agriculture is the socio-cultural dimension of farming. In this regard, Vanclay (2004, 213) states that ‘farming is a socio-cultural practice’ rather than a purely technical one, and it is therefore influenced and governed by social processes.

Modern scientific premises also support the view that farming has to be understood atomistically⁵ according to the reductionist approach, and has to be divided into separate disciplines to form separate understandings of its components and similarly, arrive at segmented solutions. Yet the isolated technologies generated from such divided understandings have often led to devastating cumulative effects (Norgaard and Sikor, 1995). Counter to this outlook is the holistic⁶ view inherent in the ecosystems based approach to farming. What is required by this holistic perspective is aptly expressed by Savory (1988, 30) as follows:

Since greater wholes have qualities and character not present in any of their constituent wholes (parts) one must seek to understand the greater whole in order to understand its parts, not vice versa.

³ Different land use functions in indigenous farming systems include: food production; wood production; soil and water conservation; crop protection; and maintenance of soil fertility (Reijntjes *et al.*, 1992).

⁴ Various biological components that constitute indigenous farming system include: livestock; food crops; fodder crops; naturally occurring plants; trees; and green manures (Reijntjes *et al.*, 1992).

⁵ The premise of atomism is that systems consist of unchanging parts and are simply the sum of their parts (Norgaard and Sikor, 1995).

⁶ The premise of holism is that parts cannot be understood apart from their wholes and wholes are different from the sum of their parts (Norgaard and Sikor, 1995).

Fig20

Likewise, the analytic literature on sustainable agriculture suggests a shift in trend -- a shift from reductionism towards holism. Conventional scientists are becoming increasingly aware that the philosophical premises on which modern agriculture is founded on are problematic. According to Norgaard and Sikor (1995) other dominant premises of conventional agriculture such as mechanism, universalism, objectivism and monism⁷, also overlook the complexities of natural and human systems.

Conversely, alternate premises on which agroecological systems are founded are less regimented and incline towards multiplicity and inclusiveness. These alternate premises hold that (a) complex systems are not mechanical, predictable or smooth because they are chaotic and in some instances evolutionary as opposed to mechanistic; (b) phenomena are dependent upon a multitude of factors and are relative to the time and place in which they occur -- contextual as opposed to universal; (c) social and natural systems cannot be understood apart from how we perceive and interact with them -- subjective as opposed to objective; and (d) complex systems can only be understood through multiple patterns of knowing which are inherently divergent -- pluralistic as opposed to monistic (Norgaard and Sikor, 1995).

This study is concerned particularly with tropical agroecosystems because they have distinct characteristics. The environment of the tropics is characterized by lack of a biological down season (winter), poor soil conditions and an extremely high degree of biodiversity. Likewise, the cultures of the tropics are also diverse and complex, still retaining certain traditional ways of managing resources. Another distinctive characteristic is that population pressure, poverty and environmental problems dramatically colour the living conditions of most societies in the tropics. As such, political forces of the tropics or the so-called 'South' drastically differ from those of the so-called 'North'. Therefore, ecological, cultural and political issues encountered in tropical agroecosystems are unique (Vandermeer, 2003), and there are many challenges to agriculture. One pronounced feature of the tropics is the climatic variability, ranging from deserts to semi arid areas and regions with extremely high rainfall. There are marked wet and dry seasons and some areas receive too much or too little rain. Likewise, yearly rainfall is subject to dramatic fluctuations. Continuously high temperatures can be detrimental to plants as they cause high levels of evaporation that consume some of the food produced by the plant

⁷ The premise of universalism is that diverse and complex phenomena are the result of universal principles and occur unchangingly in time and space, while objectivism assumes that we can remain apart from what we are trying to observe and comprehend. The premise of mechanism is that relationships between parts are fixed and systems function smoothly to achieve equilibrium, while monism assumes that separate and complex individual understandings can merge into a coherent whole (Norgaard and Sikor, 1995).

through photosynthesis. Due to climatic conditions tropical soils are subject to heavy erosion and nutrient leaching, and therefore about 90 per cent of their nutrients are contained above ground in the vegetation cover while the soil itself can be rather sterile (Dover and Talbot, 1988).

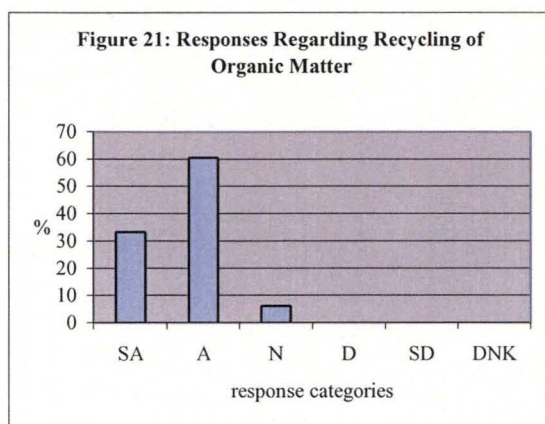
An estimated 1.4 billion people live in the diverse and risk prone rainfed marginal environments of the tropics where farming activities receive little benefit from conventional technology developed for temperate zone agriculture. Therefore, a growing number of agricultural scientists argue that traditional systems are the cornerstone for developing pro-poor approaches to agricultural development in the tropics (Altieri, 2002).

Most of these traditional and subsistence methods are complex farming systems, meant to optimise productivity in the long-term rather than maximize yields on a short-term basis. In the following sections I explore respondents' engagement with some of these agroecological principles and processes. Among these are recycling of organic matter; soil conservation; freedom from external inputs; rainwater harvesting; integration of crop and livestock; and agro-biodiversity. This exploration is attended by reference to the literature on key principles and processes that underpin traditional and subsistence farming systems.

Recycling of Organic Matter

Natural systems remain sustainable because of the nutrient recycling function of the soil organisms. In natural systems leaf fall and root exudates provide the organic matter, while in agricultural systems, various types of farm and forest materials and mulching systems are incorporated (Jordan, 1998). Small farmers usually resort to closed cycles of nutrients, energy, water and wastes in order to maintain soil fertility. Soils are enriched because farmers adopt fallow or rotational systems, incorporate legumes into the intercropping patterns and recycle organic matter such as manure and forest litter (Altieri, 1995). Approximately 94 per cent of the respondents to Questionnaire A either agreed (61 per cent) or strongly agreed (33 per cent) that recycling of biomass is an important strategy for maintaining the health of the agroecosystem (Figure 21). There was a high level of agreement that recycling of organic matter is a sustainable practice: '*recycling of biomass maintains environmental balance*' (RA11), and '*if you remove biomass there is no sustainability*' (RA30). Some simply identified recycling as a necessary or required practice (RA1, RA6, RA22), indicating that

recycling is mandatory for the sustenance of the agroecosystem. Likewise, the observation that *'biomass is part of the agroecosystem'* (RA3) and *'the whole system relies on the biomass'* (RA12) emphasises that biomass is considered integral to the agroecosystem. Therefore putting it back into the system becomes an indispensable provision, indicating that many respondents attach a high level of significance to natural cycles and their continuity within agroecosystems.



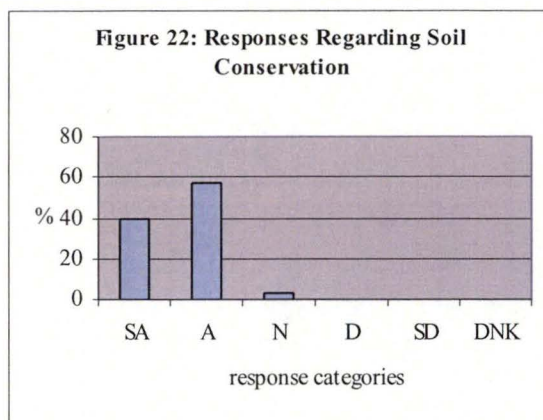
Soil fertility (RA17, RA27, RA31) and biodiversity (RA19, RA23) are cited most commonly as the derivable benefits of recycling organic matter. It was also pointed out that *'this practice is widely accepted'* (RA8), suggesting that levels of social acceptance are also influential in deciding the significance of certain agricultural practices,

possibly because of their success as 'tried and tested' methods. As Vanclay (2004, 214) explains, 'adoption takes place within a social context' and an idea or practice becomes widely adopted when it 'has become part of a normative concept of good farm management'. However, there seems to be some indication that although organic matter recycling is seen in a favourable light by many farmers in Sri Lanka it is usually confined to traditional farming operations as suggested by the observation that *'this is practised in traditional farming but the practice is not so evident in present day farming'* (RA4). Another slant to this statement is that it suggests that certain traditional practices are on the decline despite recognized benefits. This decline may be due to the labour intensiveness of the practice. As pointed out by Jordan (1998), one drawback with nutrient recycling is the laborious effort required to move the material from its source to where it is utilized.

Soil Conservation

Among the principal requirements for maintaining soil health are efficiency in the utilization of rainwater; prevention of soil erosion; and the application of fertilizer. While maintenance of crop residues on the surface of the soil addresses these requirements (So *et al.*, 2001)

conservation tillage⁸ practices enhance the build-up of organic matter in the soil, and curtail erosion and compaction (Jordan, 1998). Physical structures such as terraces or various sized bunds for conserving soil nutrients are often observed in indigenous agricultural systems.



They serve the dual purpose of water harvesting and retention (Reij, 1991). An overwhelming majority of about 97 per cent of respondents to Questionnaire A either agreed (58 per cent) or strongly agreed (39 per cent) that soil conservation is an important practice to maintain the continuity of the agroecosystem (Figure 22). It was noted that *'soil is a limited*

resource' (RA31) and *'fertile soil is fundamental to the agroecosystem'* (RA3). A crucial need to conserve and maintain soil fertility is clearly recognized by the respondents. A significant proportion of the respondents were concerned with environmental effects such as soil erosion, destruction of soil organisms and desertification that could take place if soil conservation practices are not carried out (RA6, RA7, RA11, RA13). Desertification is mainly the result of climate variability and unsustainable human activities. It has both environmental and socio-economic consequences. The most easily damaged resources of the drylands are the biological and economic resources such as soil, water and vegetation. Indisputably, desertification has enormous social costs, as it can undermine food production and even social stability (UNCCD, 2004).

Another theme that arose in response to soil conservation was reference to past and present practices of managing soil fertility. Respondents observed that *'soil conservation was practised in traditional farming'* (RA4), implying that these systems can serve as examples for current farming operations. *'Although this [soil conservation] was not necessary in the past in chena cultivation, in present day practice this is necessary'* (RA1). It appears that the current necessity for soil conservation is emphasized as part of a larger or more pronounced concern over shortened fallow periods. The method of shifting cultivation in itself was a technique devised by traditional farmers to protect resources. However, such measures have become less effective in recent times because of population pressures and changing economic and political circumstances. The relatively low priority given to environmental protection by

⁸Includes no-till and minimum-till practices (Jordan, 1998).

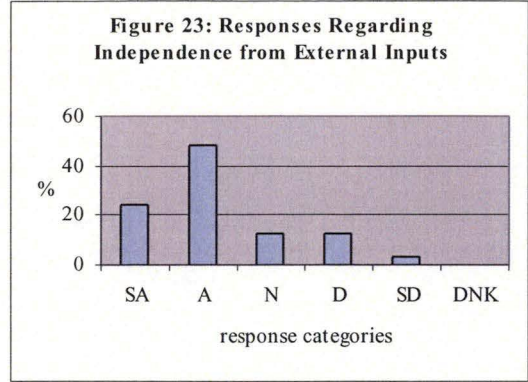
subsistence farmers as a result of poverty and lack of alternatives tends to lead to poor land management decisions (UNCCD, 2004).

Since present day subsistence farming systems are viewed by respondents as being subject to more intense pressures and therefore as being more likely to contribute to resource degradation, it follows that *'soil conservation techniques adopted 10-25 years ago will not be adequate for the present situation'* (RA17). This observation suggests that soil conservation measures need to be updated to suit current conditions and to address specific problems unique to that particular locality. It is possible that existing soil conservation practices are ineffectual, as indicated by the observation that *'soil erosion mainly due to improper farming techniques is seriously affecting the agroecosystems'* (RA16); hence the need to renew and upgrade such practices are being acknowledged. More specifically, chena cultivation seems to be the area of most concern as indicated by commentary such as: *'chena cultivation can result in soil erosion'* (RA14) and therefore *'chena cultivation should be modernized to suit present conditions'* (RA8). This phenomenon of decline in soil resources is also documented in the literature that, although indigenous systems adopt various soil and water conservation techniques, that are well adapted to local conditions, soil erosion continues to be a widespread problem in many parts of the world. Existing systems alone are inadequate (Reij, 1991). Overall, the need to update outmoded practices to counter current trends in resource degradation is a strong theme within the research data. Although traditional systems are seen as models for resource-conserving technologies there seems to be a high level of agreement that soil conservation is an area where further innovations and evolutionary changes are required.

Independence from External Resources

In adopting modern agricultural technologies based on external inputs there are many hidden environmental and social costs in addition to the financial costs encountered by peoples of developing countries. Ultimately populations and farmers derive little benefit from modern agricultural strategies that rely on costly external packages (Pretty, 1995). When asked whether independence from external inputs, (in other words reliance on local knowledge, resources and inputs) is considered beneficial about 72 per cent of the respondents to Questionnaire A either agreed (48 per cent) or strongly agreed (24 per cent) on this point (Figure 23). The reason indicated for the preference for local resources and inputs is that

‘these are suited to local conditions’ (RA7) or, in other words are *‘suitable for local people and circumstances’* (RA4). There appears to be a perception that local knowledge and



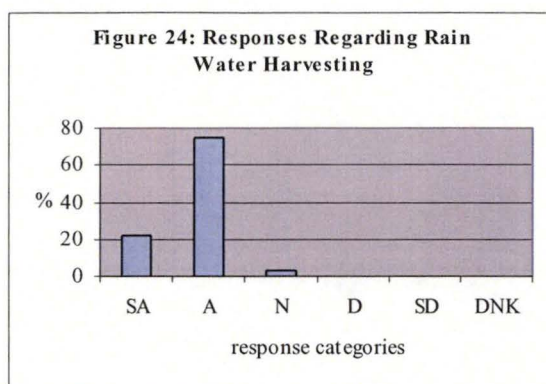
technology can pliantly blend with the socio-economic fabric of the locality. It is also recognized that *‘local techniques are more environment friendly’* (RA14) and that *‘local knowledge and resources can help in achieving environmental sustainability’* (RA20), indicating that local knowledge and practices are perceived as being suitable for environmental peculiarities

of a locality. In addition to the environmental benefits of freedom from external inputs, implications for human health are also elaborated such as *‘food should be grown free of poisonous substances’* (RA1) and *‘it is necessary to adopt practices that are not harmful to health’* (RA8).

Although the need to take advantage of local knowledge and practices is emphasized in general, there is a view that the total elimination of external inputs is not possible. This view is reflected in the response that *‘external technology should be modified according to our needs’* (RA11), suggesting a preference towards adaptation and innovation.

Respondents also pointed out that *‘local knowledge systems should be consolidated’* (RA6), indicating that perhaps such systems are seen as being scattered and dispersed among many different communities and localities; existing as fragments or vestigial forms of once complete knowledge systems in which case, needs to be systematically collected, studied and documented. In addition, the view that *‘farmers need training in this area’* (RA6) suggests a need to facilitate a much wider dissemination of traditional knowledge systems as a vehicle for technology transfer and perhaps as a means to ensure the continuity of these systems. Since farmers are the keepers of most of the traditional farming knowledge, it is possible that the dissemination of this knowledge is envisaged as a sort of horizontal diffusion from farmer to farmer instead of the conventional top-down approach to farmer training.

Rainwater Harvesting



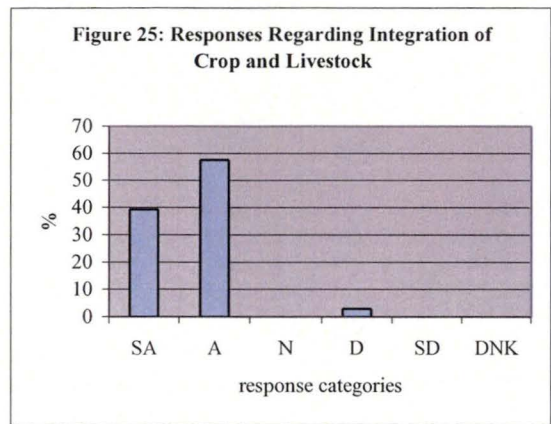
In rainfed areas with agricultural potential, cropping types and patterns are determined by the amount and distribution of rainfall. Therefore in drought prone areas small farmers select drought tolerant crops. Management techniques usually involve use of soil cover to minimize water runoff and evaporation of soil moisture (Altieri, 1995). As a water and soil

conservation measure small farmers also resort to water harvesting systems where runoff is collected and directed to areas where it can be utilized within the agroecosystem (Reij, 1991). Approximately 97 per cent of respondents to Questionnaire A either agreed (75 per cent) or strongly agreed (22 per cent) on the importance of harvesting rainwater (Figure 24). A majority pointed to the fact that large-scale village reservoirs already fulfilled this purpose. However, a considerable number of respondents also stressed the need for small-scale harvesting of rainwater as discernible from responses such as: *'it is a good practice to collect and use rainwater at the household level'* (RA7); *'it is important for every household to collect rainwater'* (RA10); and *'this [rainwater harvesting] should be carried out at the household and village level'* (RA14). It is evident that there is much concern among respondents regarding water shortages during the dry season, or during periods of drought or disrupted rainfall. Rainwater harvesting is seen as a partial solution to an otherwise calamitous dry spell (RA14, RA16, RA17, RA22, RA23).

Another view regarding rainwater harvesting is that traditional farming practices maximize this particular strategy, as indicated by responses such as *'this [rainwater harvesting] was used in traditional farming'* (RA4) and *'this is a traditional practice'* (RA11). The prominence of this practice in traditional farming is similarly emphasized by pointing to the network of repositories or reservoirs in Sri Lanka's dry zone as having played a crucial part in traditional farming. This view is evident in responses such as *'traditionally large network of tanks enabled the collection of rainwater'* (RA13) and *'in the past this was achieved through village tanks'* (RA6). Overall, rainwater harvesting is perceived as a traditional farming practice that is extant in the form of large-scale networks of reservoirs. However, much interest is displayed in the need to promote this on a small-scale or household level, which is

more appropriate for the subsistence needs of small farmers working on marginal lands that are non-irrigable through large-scale irrigation networks.

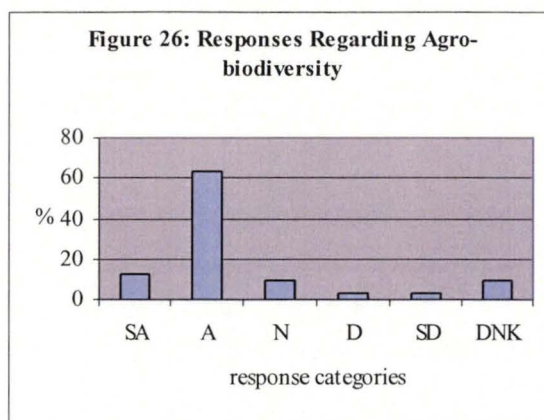
Integration of Crops and Livestock



In sustainable farming systems livestock provide a cheap source of organic nutrients to the soil. Small farmers widely resort to the practice of incorporating crop and livestock as livestock manures have a positive effect on soil structure, water retention and soil organisms (Pretty, 1995). Roughly 97 per cent of the respondents to Questionnaire A either agreed

(58 per cent) or strongly agreed (39 per cent) that integration of crop and livestock within an agroecosystem is important to maintain its robustness (Figure 25). Plant-animal synergies contribute to mutual benefits among agroecosystem components (RA6, RA16, RA22, RA31). Respondents also observed that *‘livestock is important for holistic farming systems’* (RA14) and *‘integrated farming is a better way to carry out an economically and physically viable process’* (RA17). It is evident that integration of different components and a holistic approach to farming is favoured. The observation that *‘it is a natural system’* (RA30) suggests that a natural system, or at least one mimicking nature, is considered essentially good and beneficial. A fundamental premise of the agroecological strategy is that agroecosystems should mimic the functions of local ecosystems with the expectation that these agricultural mimics will then emulate the productive capacity, pest resistance and conservation principles of their natural models (Ewel, 1999). The observation that *‘this synergism (crop and livestock integration) enhances the ecosystem’* (RA20) invariably suggests that integration leads to enriched systems. Likewise, socio-economic benefits are also seen as end results of an integrated system. Enhanced agricultural productivity, increased per area income, and reduction in the cost of farm operations are cited as benefits. This view is reflected in comments such as: *‘it gives very productive results’* (RA9); *‘enables the maintenance of a better and cheaper livelihood’* (RA22); and *‘[it] can increase income per area’* (RA31). At the same time, the theme of tradition is explicitly expressed in responses such as *‘this is consistent with traditional farming’* (RA2) and *‘this was an important element in traditional farming’* (RA4).

Agro-biodiversity



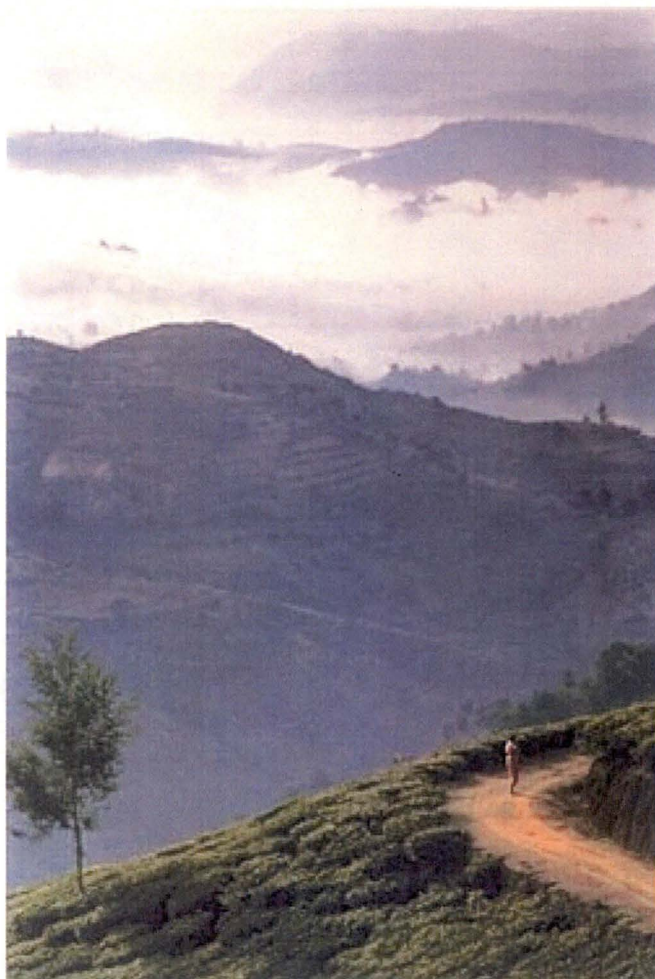
Agricultural biodiversity has been acknowledged as the keystone of stability for sustainable agriculture. It encompasses a wide range of diversity among plants, animal genetic resources, soil organisms and other flora and fauna within the ecosystem. Agricultural biodiversity enables a farmer to carry out nutrient recycling, counter pest and disease

problems, conserve soil and water, cushion climatic stresses while maintaining agricultural productivity. It therefore proffers both ecological and socio-economic advantages (Thrupp, 1999). About 76 per cent of the respondents to Questionnaire A either agreed (64 per cent) or strongly agreed (12 per cent) that it is important to establish species and genetic diversification of the agroecosystem in time and space (Figure 26). A dominant theme was that diversification was identified as a common feature in traditional farming systems as expressed in responses such as '*diversification of crops was widely practised by traditional farmers*' (RA6); '*traditional farming systems included diverse crop varieties*' (RA10); and '*in traditional chena cultivation, there is a wide variety of crops*' (RA14). In fact, Thrupp (1999) points out that traditional farmers throughout the centuries have employed numerous practices to ensure agricultural biodiversity, which has resulted in an enormous variety of plants. However, it is observed that due to '*foreign influences this practice [diversification] is disappearing*' (RA2) and '*modern cultivation patterns have led to loss of many traditional varieties*' (RA11) and '*nowadays only high yielding varieties are grown*' (RA14). It is evident that modern monocultural farming practices are seen to contribute to the displacement of traditional varieties and cropping patterns. With implications for policy, it is noted that '*currently no action is being taken to promote this [crop diversification] on a national scale*' (RA23) and that crop diversification '*must take place on a national scale*' (RA2).

Summary

A critical exploration of respondents' attitudes towards certain agroecological practices unveiled several themes. Recycling of organic matter was recognized as important for the proper functioning and sustenance of agroecosystems and therefore recycling was considered

vital for the robustness of agroecosystems. It was also acknowledged that recycling of organic matter offered benefits such as soil fertility and biodiversity. It has been considered as tried and tested, and therefore a socially accepted practice. However, the practice is mostly confined to traditional farming operations and is now on the decline despite its recognized benefits. Respondents' perceptions about soil conservation practices indicated that soil fertility is crucial to the sustainability of an agroecosystem, which would otherwise result in soil erosion, destruction of soil organisms and desertification. Respondents were overwhelmingly of the view that although soil conservation was widely practised by traditional farmers in the past, these practices are no longer effective in present day circumstances due to more intense pressure on the resource base. Therefore, outmoded practices need to be updated to meet current conditions. Respondents' ideas on independence from external inputs are that local knowledge and practices are more suitable for environmental and socio-economic peculiarities of a locality as well as being safe for human health. Although total elimination of external inputs is not possible it is beneficial to adapt and innovate modern technology to suit local need. On the other hand, it was noted that local knowledge and technology needs to be systematically compiled, facilitating technology transfer among farmers for the preservation and continuity of these knowledge systems. Respondents' view on rainwater harvesting was that large irrigation networks served this function in traditional irrigated farming systems. However, subsistence farming will benefit if this is practised on a small-scale, household level as a partial solution to water shortages during dry spells. Respondents' ideas on integration of crop and livestock emphasized both environmental and socio-economic benefits. Enhancing the interrelationships within the agroecosystem and mimicking natural systems ensures robustness of an agroecosystem. Respondents' perceptions of agro-biodiversity is that diversification is a key feature in traditional farming systems. However, the influence of modernized monocultural methods is responsible for displacing many traditional varieties of crops. Currently there are no policy measures to address this problem.

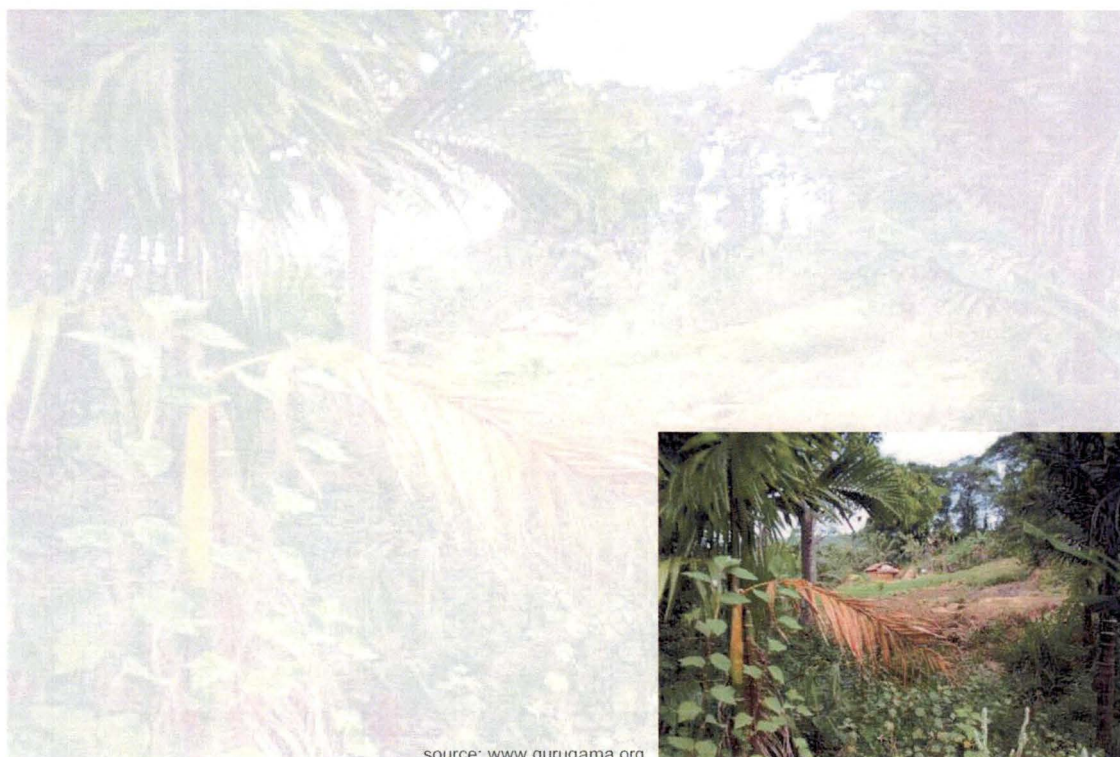


Chapter 5

Respondents' Perceptions on Chena Cultivation and Kandyan Homegardens

Photo: Luke Powell, 1996

Photo: Luke Powell, 1996



source: www.gurugama.org

CHAPTER 5

Respondents' Perceptions on Chena Cultivation and Kandyan Homegardens

Chena Cultivation

In Sri Lanka, shifting cultivation known as chena cultivation involves cutting and burning of the virgin or secondary jungle after which a mixed cropping of cereals, legumes, vegetables and condiments are grown for one to three seasons in the cleared plot. After the cropping phase the plot is then abandoned and left to lie fallow and the forest growth restores the soil. In addition, the re-colonizing forest cover provides fuel wood and fodder for livestock. Traditionally the fallow periods ranged about 15-20 years although in recent years this has been drastically reduced. Chena farming relies mostly on family labour and external inputs are rarely used (Abeyratne *et al.*, 1986).

Technically forest clearing is prohibited by the Forest Department. Yet the reality is that a large number of resource poor farmers rely on chena cultivation for their livelihoods. Although forest clearing is punishable by law, the practice persists. Since chena farming is not recognized as legitimate, chena farmers are highly marginalized and belong to the poorest segment of Sri Lankan society. They do not receive any extension services, financial assistance, compensation for crop loss or subsidies available to other types of farming (Dissanaike, 2004). Thus chena farming is largely ignored by government institutional structures.

Chena farming is typically subsistent or semi-commercialised, although fully commercialised chena operations have also been reported (Abeyratne *et al.*, 1986). Usually chena cultivation is the only means of livelihood for landless farmers. For the subsistence farmer, chena cultivation offers several advantages. It provides a supplementary source of food; it offers a form of crop insurance against failures of irrigated paddy cultivation; and enables farmers to obtain food throughout the main (*Maha*) and minor (*Yala*) planting seasons. The mixed

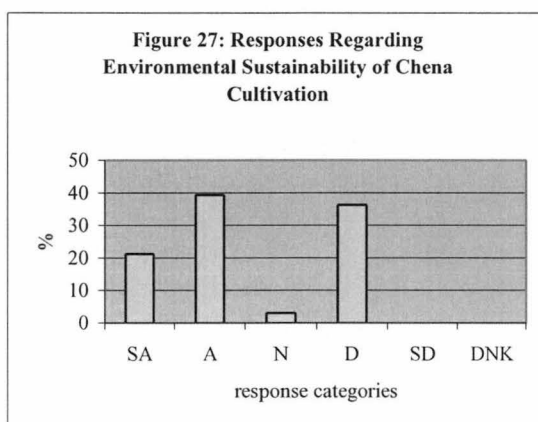
cropping patterns which is characteristic of chena cultivation ensures at least some measure of harvest during seasons of extreme rainfall (Tennakoon, 1986).

Until the 1950s, the areal expansion of chena cultivation was limited as a result of very low population pressure. Fallow periods maintained in chena cultivation were adequate -- about 10 years before re-cultivation. This situation could be attributed to several factors. There was low population density and extensive tracts of forested areas were available while only a small number of farmers resorted to chena cultivation. On the other hand, national policy concentrated on development of intensive irrigated paddy cultivation. Similarly, market forces enabled the purchase of subsidiary food crops at reasonable prices from overseas, hence providing no incentive to grow other cereals apart from rice paddy (Tennakoon, 1986).

During the 1960s and 1970s, however, there were notable pressures and demands on chena cultivation brought about by several factors, among them: (a) import restrictions imposed on subsidiary food crops due to decline in Sri Lanka's foreign exchange; (b) population growth and increased population pressure on land resources; (c) extension of irrigated paddy cultivation under rehabilitated irrigation schemes to even marginal lands previously available for chena cultivation; and (d) landless rural settlers being compelled to grow subsistence food wherever possible in response to rising cost of food items. These developments led to intensified land clearing for chena cultivation. As a result, there was a notable decline in forest cover and fallow periods barely reached five years (Tennakoon, 1986). By the 1980s, on average the fallow periods had shrunk to under five years (Abeyratne *et al.*, 1986). The resultant environmental repercussions of forest loss were manifold. These included increased surface evaporation of streams and water holes; unchecked wind erosion during the dry season; accelerated soil erosion during the rainy season; siltation; and decline in wildlife populations (Tennakoon, 1986).

When asked whether chena cultivation can be viewed as a sustainable practice if carried out with sufficiently long fallow periods, about 60 per cent of the respondents to Questionnaire A agreed (39 per cent) or strongly agreed (21 per cent) that it can be a sustainable system (Figure 27). Traditional chena cultivation systems were seen as sustainable whereas present day chena cultivation practices are not. This view is illustrated by responses such as: '*in the past traditional farmers have been able to engage in this method of farming in an environmentally friendly manner, although this method is problematic today*' (RA1) and

‘although this system has deteriorated today the traditional system was a stable method of farming’ (RA4). Tradition is acknowledged as being intrinsically good as reflected in the statement that *‘traditional chena cultivation method was a very good system’* (RA5). However, resource constraints were commonly cited as an impediment to the sustainability of traditional systems: *‘this method is problematic today due to population pressure and scarce resources’* (RA1) and *‘based on present day scarcity of resources, this is not such a good practice’* (RA8). Therefore the view is that traditions are no longer viable due to resource constraints.



A number of respondents emphasized the importance of fallowing: *‘once a chena is cultivated for 3-4 seasons it is left to lie fallow for about 10-15 years. By this time the forest has become regenerated’* (RA10); and *‘it is essential to carry out sufficient intervals [fallow period] in between forest clearing in order to make this method an environmentally sustainable farming practice’* (RA27). The

fallow period is seen as one of the most crucial factors in determining sustainability of the chena system. Traditionally chena cultivation with fallow periods of about 15-20 years posed no problems as the system of shifting cultivation with long fallow periods is one of the most effective land use systems for sustaining the productivity of tropical soils. From the farmers’ point of view fallowing is considered an effective means to maintain soil fertility and weed control. In recent times however, fallow periods have declined drastically in length. Farmers have attributed a range of reasons that compel them to shorten the fallow period. Among them are lack of forestland; competition from migrant farmers; government restrictions on forest clearing; and less effort in cultivating already cleared land. In fact shortened fallow periods that could eventually lead to non-fallowing, are of a trend towards semi-permanent or permanent cultivation, either voluntarily or involuntarily (Abeyratne *et al.*, 1986).

The ecological significance of fallowing is highlighted in a study where scientists studying elephant ecology in southern Sri Lanka discovered that the age-old practice of chena cultivation has co-existed with elephant populations in the area for thousands of years in a highly complimentary manner. Fallow and abandoned chenas provided ideal habitat and

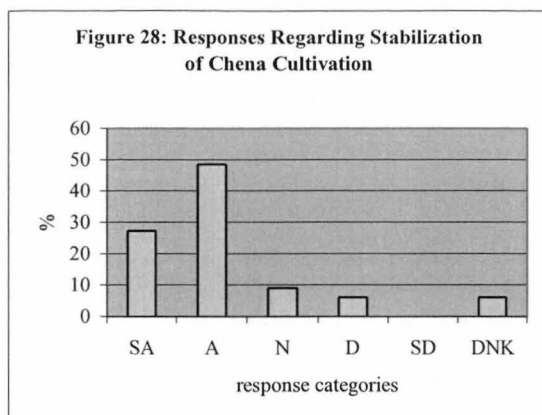
feeding grounds for herds of elephants as the elephant is an 'edge species' that prefers secondary forests and open scrub instead of dense mature forests. Although conflict between chena farmers and elephants is not entirely absent scientists have observed that the incidence of elephants raiding chenas was much less as compared to the high incidence of elephants raiding areas of irrigated, permanent cultivation. This conflict is due to the fact that permanent cultivation takes land away from elephants as it is cultivated all year round, whereas chena cultivation occupies the land only for a short period of time after which it is allowed to return to its natural state. Hence the landscape is not altered in a drastic manner in addition to the benefit of providing an ideal habitat for elephants during the fallow period (Dissanaike, 2004). Despite the stigma attached to chena cultivation as a backward form of farming, chena cultivation seems to offer a valuable ecological service. In this vein, Fernando (in Dissanaike, 2004, 9) proposes that chena farming should be continued in a more regulated manner owing to its ecological significance for wildlife:

Traditional ecological chena cultivation has been going on in the low land dry zone of Sri Lanka for thousands of years and the environment and the animals have adapted to and taken advantage of this sort of land management. So it is best to set some basic rules and guidelines now and regulate it. Allow it, but manage it, so that the practice is sustained and the chena farmers' lot is improved and the same land can be used as crucial elephant habitat in the dry periods.

Another attribute of chena cultivation that is perceived as being environmentally advantageous is that *'for chena cultivation, there is no need for any external inputs'* (RA30). Likewise, it was pointed out that chena cultivation is *'an environmentally sustainable farming practice as there is very little soil disturbance taking place'* (RA17). As pointed out by Jordan (1998) in contrast to modern farming practices, which cause intensive disturbances and consequent damage to the soil, shifting cultivation does little damage to the soil organic matter. Although the forest debris are burnt, the remaining carbon becomes the basis for functioning of the system for several years before the soil becomes diminished and the farmer is required to move on to another plot. On this basis, it is possible to view chena cultivation as a self-sustaining system with little need for inputs and minimum damage to the soil system.

It is postulated that stabilization of chena cultivation can increase productivity and profitability while decreasing resource degradation (Vitebsky, 1984). There is a general

assumption among respondents that the problem with chena cultivation lies in its shifting nature and that this needs to be solved by ‘stabilization’. When asked whether chena



cultivation should be transformed into a more stabilized form of highland farming, approximately 75 per cent of the respondents to Questionnaire A agreed (48 per cent) or strongly agreed (27 per cent), expressing concern over negative ecological impacts of shifting cultivation when faced with population pressure and decline in the availability of

resources (Figure 28). Therefore, permanent agriculture is preferred by the majority of respondents: ‘since forested land is very limited, it is not possible to clear forests annually’ (RA7); ‘this [stabilized farming] is suitable because there is a scarcity of land, and forested areas’ (RA10); and ‘because of current resource degradation, this method [stabilized farming] is suitable’ (RA13). Such responses reflect concern over resource issues. In addition, increased productivity is also seen as an end goal of stabilization as expressed by one respondent that ‘in order to get high productivity from scarce land it is a practice [chena cultivation] that should be converted [to stabilized farming]’ (RA2). However, Vitebsky (1984) points out the inherent contradictions of stabilizing chena cultivation as the need to *decrease* a process which is considered detrimental such as resource degradation and the need to *increase* something which is considered positive such as productivity and profits tend to pull in different directions. Vitebsky (1984, 9) also makes the important policy observation that:

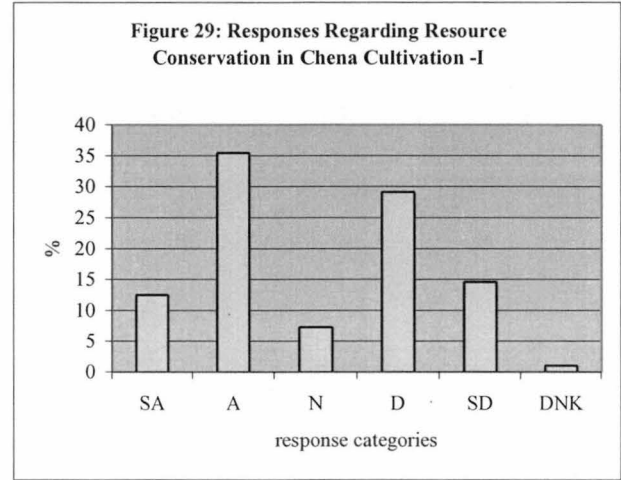
There is thus a contradiction at the heart of the chena policy, and it is irrational to assume that it will be easy to split these factors and send them in opposite directions, namely to increase some tendencies and to decrease others.

Therefore, it appears that the idea to stabilize chena cultivation is difficult to pin down. Stabilized chena cultivation, more commonly referred to as stabilized highland farming is a form of sedentary farming, where farmers are permanently made to reside in and cultivate highland plots of land allotted to them. Although this method of farming is seen as a promising alternative to chena cultivation, it is not certain whether stabilized highland farms can be successful, given the soil characteristics and the drought conditions of the dry zone

where chena cultivation is widespread (Tennakoon, 1986). Another aspect of stabilized chena cultivation that leads one to question this agricultural model is the respondents' emphasis on conservation methods which surfaced as a noticeable theme, if chena cultivation is to be converted to a form of stabilized highland farming. This view is evident from responses such as *'since the land is continuously used, must adopt conservation measures'* (RA14) and *'this [stabilized farming] should be carried out in a manner that provides conservation'* (RA8). This observation connotes that although in favour of stabilized farming, some hold the tacit belief that stabilized forms of farming requires mandatory incorporation of conservation measures in contrast to traditional chena cultivation. Such a standpoint leads one to question whether chena cultivation is in fact viewed as a resource-conserving farming system in itself despite the general perception that chena farming needs to be stabilized, in which case compulsory conservation measures are required. A related irony is that chena cultivation is viewed as having environmental benefits, although support for stabilized farming is openly expressed by one respondent. The respondent agreed that chena cultivation should be stabilized due to resource constraints but made the observation that *'it [stabilized farming] presents several other problems. This will require the use of pesticides and fertilizer. The environmental friendly attributes of chena cultivation will no longer exist'* (RA13). Likewise, stabilization seems to be viewed with a certain degree of scepticism as indicated by the response *'I doubt whether this system can offer the expected levels of success'* (RA10). However, there is also the opinion that *'this method [stabilized highland farming] has been experimented and it has been very successful'* (RA3). In general, respondents' views on stabilized chena cultivation reveal an uneasy alliance between ideas that support 'stabilized systems' and ideas that acknowledge certain ecological advantages of 'shifting cultivation'. Opinions seem to be divided about the success of stabilized chena cultivation among the respondents. However, the majority support for stabilization could be due to a prevailing belief that *'there is no other alternative'* (RA30) to the heightening pressures on scarce resources and therefore a stabilized system is the solution.

The divergence in attitudes regarding resource conservation in chena cultivation is further highlighted when the respondents were asked more in-depth questions on this issue. In general, only 48 per cent of the respondents to Questionnaire A either agreed (35 per cent) or strongly agreed (13 per cent) that chena cultivation conserved local resources such as soil water and biodiversity (Figure 29). About 44 per cent of the respondents either disagreed (29 per cent) or strongly disagreed (15 per cent) on this point. Figure 30 provides a more detailed

illustration of respondents' views on conservation of resources such as soil, water and biodiversity. Those who acknowledge the resource-conserving nature of chena cultivation generally pointed out that *'farmers use soil conservation measures after land clearing.'* (RA7); *'very little soil disturbance takes place. As such it does not aggravate soil erosion'* (RA17); *'chena cultivation is done in rainfed areas. Stored up tank water is not used for this'* (RA13); *'various methods are used to ensure rainwater is retained in the soil. Crop varieties that do not require too much water are cultivated.'* (RA14); *'the chena is prepared in a manner that causes minimum destruction to biodiversity'* (RA12) and *'in chenas a variety of crops are grown. And also chenas are not cultivated on the same land for years. As such it paves the way for a diversity of fauna and flora to thrive on'* (RA17).

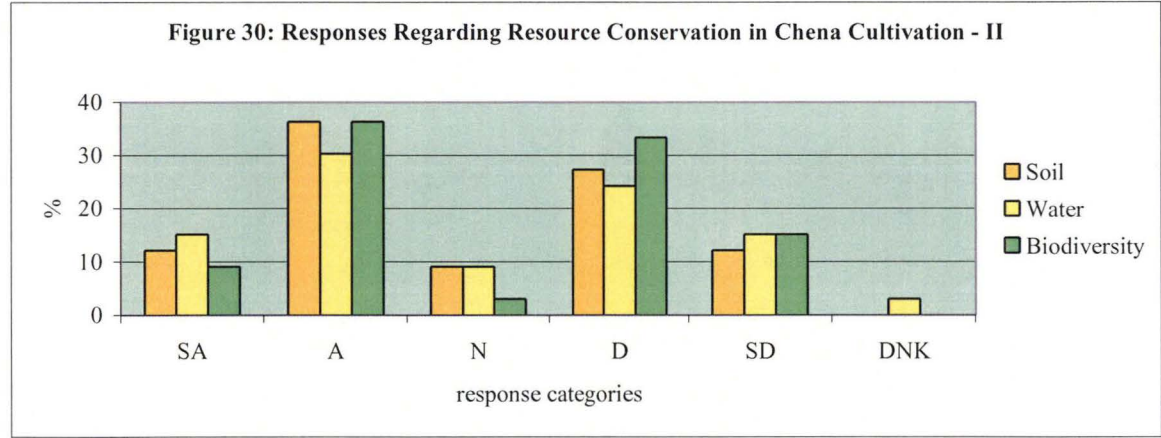


Conversely, those who perceive chena cultivation as detrimental to resource conservation pointed out that *'unlike in the past, present day farmers do not engage in soil conservation practices'* (RA1); *'due to removal of forest cover, soil erosion can happen'* (RA31); *'this could destroy watersheds and cause water shortages. Disrupted rainfall*

patterns could adversely affect the ecosystem' (RA19); *'the chena cultivation method depends upon rainwater, so they do not use water conservation methods'* (RA27); *'forest burning cannot protect biodiversity'* (RA18); and *'damages certain plant and animal species'* (RA31). These responses suggest a 'tug-of-war' among opinions held by the members of these two groups in relation to the effects of chena cultivation on physical and biological resources.

The *New Agriculturist* (1999) reports that shifting cultivation, which supports about 300-500 million people worldwide, is practised by indigenous groups whose members have engaged in this form of farming for centuries as well as by migrant farmers who reclaim forest areas. The latter group possesses no intimate knowledge of the new environments that they cultivate and nor are they familiar with traditional resource management practices. As a result they are less successful than indigenous groups in ensuring resource conservation and sustainability of the land that they cultivate. The observation that *'farmers no longer adhere to traditional practices'* (RA1) quite possibly describe this particular group of cultivators. This

phenomenon may indicate why opinions remain divided over the environmental effects of chena cultivation. Thus, it is possible that the conflicting accounts of environmental impacts (i.e. resource degradation and resource conservation) reported by respondents are both quite valid due to the fact that traditional farmers and immigrant farmers differ in the manner in which they impact the environment that they cultivate. There is an indication here that the respondents understand this aspect of chena cultivation through vastly different discourses. Nevertheless, there is debate over the exact role that shifting cultivation plays in deforestation and loss of biodiversity in the tropics. The share of accountability assigned to shifting cultivation as a major cause of deforestation may be overrated because of obscure definitions, possible political biases, and vague estimations (Angelsen, 1995). In general the two main causes of tropical deforestation are seen largely as a result of logging activities and the expansion of subsistence agriculture. Yet, the complexity of underlying factors and the attempts to transform traditional farming systems have revealed that what is required is a better understanding of various land use practices that are generally characterized as shifting cultivation (*New Agriculturist*, 1999).



Vitebsky (1984) describes chena cultivation as the most basic and ecologically adapted form of land use in Sri Lanka’s dry zone whereas irrigated paddy is more a supplemental and vulnerable form of farming among subsistent farmers. When respondents were asked about their views on adaptive attributes of chena cultivation about 49 per cent of the respondents to Questionnaire A either agreed (40 per cent) or strongly agreed (9 per cent) that chena is well adapted to environmental constraints such as marginal lands, marginal soils and pests (Figure 31). About 26 per cent of the respondents disagreed (25 per cent) or strongly disagreed (1 per cent) on this point while 24 per cent answered either that they were neutral or that they did not know.

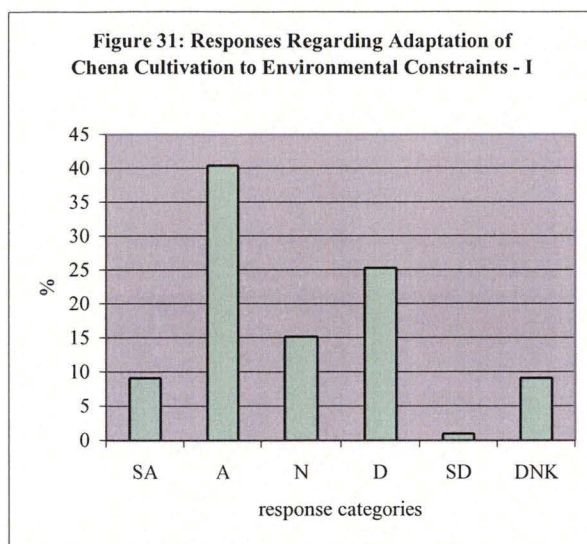
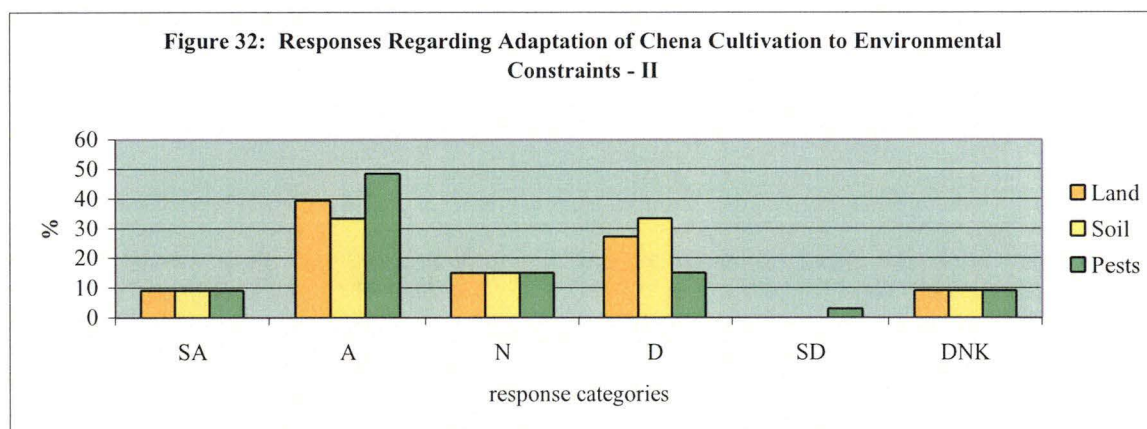


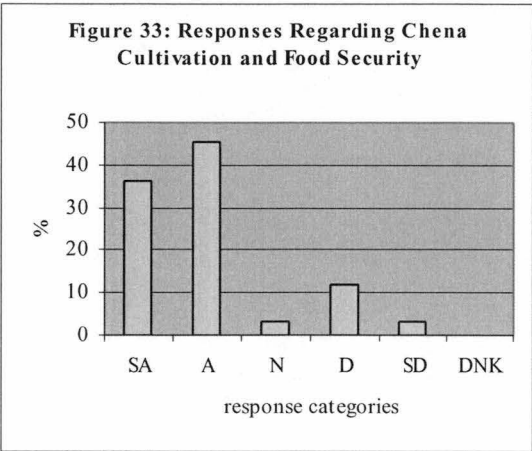
Figure 32 provides a more detailed presentation of respondents' views on adaptation of chena cultivation to environmental constraints such as pests and marginal lands and soils. Those who viewed chena cultivation as being adaptive to environmental constraints generally pointed out that '*chena cultivation is carried out only in forests which are of inferior quality. Thickly grown forests are not destroyed*' (RA9) and '*highly fertile lands and soils are*

not used for chena cultivation' thus indicating that the chena cultivation has the ability to thrive in marginal environments. There are contrary views however that '*chena cultivation is usually carried out in fertile land and soil. This only degrades these resources*' (RA6). Again the dichotomous views indicate conflicting discourses.



In terms of adaptations to pest problems there is general consensus that pesticide use is minimal or absent indicating that a high level of adaptability is perceived in this area. It is observed that '*no pesticides are used*' (RA3, RA6) or '*pesticides are used minimally*' (RA12). Likewise, traditional systems are credited as being pest resistant as follows: '*traditional farming systems are resistant to pest infestations*' (RA4) and '*traditional farmers adopt various practices to ensure that the chena does not become susceptible to pest infestations*' (RA9). Furthermore, views on present day chena cultivation or modern practices within the chena express that '*because of western influence chena cultivation is no longer carried out*

according to traditional practices. Therefore, crops greatly suffer pest infestations’ (RA1) and ‘[chena cultivation is] not suitable for adopting western influenced cropping systems as this allows a high level of pest infestation’ (RA8). Likewise, the theme of tradition and its benefits is frequently intertwined with the respondents’ observations, suggesting that there is a prevailing view that customary practices are directed towards ecological adaptation, and therefore must remain part and parcel of the chena cultivation system.

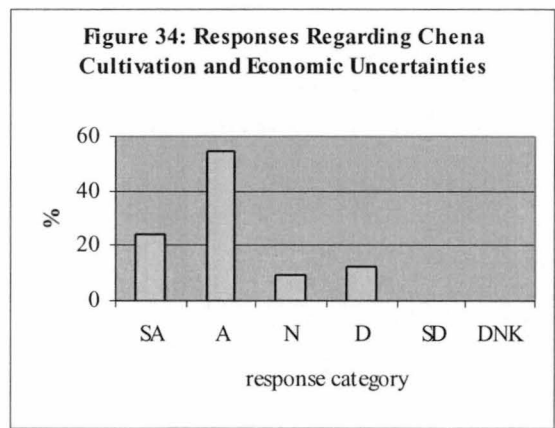


In the same manner that environmental implications cannot be ignored, the socio-economic value of chena cultivation in a subsistence society also cannot be overlooked. The choice of crops in the chena is largely determined by the purpose of utilisation -- either for household consumption or for income generation. Other factors that influence the choice of crops to be grown include crop

duration¹, climate adaptability, tolerance to pest and disease, resilience to damage by wild animals, and the option of using less demanding management practices. It is not uncommon for farmers to grow various traditional crop varieties as well as introduced varieties in the chena (Abeyratne *et al.*, 1986). On the subject of food security approximately 81 per cent of the respondents to Questionnaire A either agreed (45 per cent) or strongly agreed (36 per cent) that chena farming system provides year round food security to subsistence farmers (Figure 33). Within these responses two salient themes emerged: one, likening the chena to a food storage system; and the other, its ability to provide a variety of food crops. These views were reflected in responses such as ‘a wide variety of cereals are grown in the chena. These are harvested at different times when needed’ (RA5); ‘once a chena is cultivated it provides greens, vegetables, cereals throughout the year. The chena is like a food storage’ (RA1); and ‘the various crops grown in the chena can be harvested all year round. These can also be stored throughout the year’ (RA23). Crop variety that is attributable to the commonly used mixed cropping patterns in the chena is viewed as a significant benefit to subsistence farmers. Crop diversification is a useful strategy for satisfying household food requirements as well as making adjustments in the cropping patterns based on resource availability (Daléus, 1988).

¹ When farming under rainfed conditions crop duration becomes an important factor. Under such conditions short duration crops such as green gram, gingelly, ground and cowpea are preferred (Abeyratne *et al.*, 1986).

The crop variety and different harvesting cycles within the chena, which enable the farmer to obtain some form of harvest during different times of the year, are considered as significant advantages in terms of food security. In addition, most chena crops can be harvested and stored away for future use, which is another attribute considered useful for ensuring food security.



Still on the subject of socio-economic attributes of chena cultivation, when asked whether chena cultivation provided relief to farmers during times of economic uncertainties about 79 per cent of the respondents to Questionnaire A either agreed (55 per cent) or strongly agreed (24 per cent) on this point (Figure 34). The majority emphasised the

importance of stored crops as well as cash crops as significant buffers during economically difficult periods. This attitude is corroborated in views such as ‘chena farming can be quite valuable as it grows cereal varieties which can be stored for a period of time’ (RA2); ‘during periods of economic difficulty, out of the stored crops farmers keep some for consumption and sell the rest’ (RA5); ‘except vegetables other crops such as cereals can be stored throughout the year to be used during times of need’ (RA8); and ‘food crops grown in the Maha season are mostly consumed but some are stored away. The excess is sold. During the Yala season cash crops are grown for sale’ (RA14). The low input requirement of chena cultivation is also seen as an economic advantage as evident from statements such as ‘for chena cultivation no outside inputs [are needed]. It is a self sufficient system’ (RA30) and ‘if poor farmers do not have any economic relief they automatically turn to chena cultivation because there is no need to use manure, high quality seeds et cetera’ (RA18). This view is supported by the fact that that shifting cultivation offers economic leeway as it requires very little capital on the basis of labour and consumption of soil fertility. The only inputs required are manual labour and seed materials (Thenabadu, 1982). Overall, chena cultivation is viewed as a socio-economic necessity brought about by economic circumstances as it ensures survival for subsistence farmers. Tennakoon (1986) points out that farmers in Sri Lanka’s Dry zone where chena cultivation is widely practised, in fact prioritize timely sowing of the chena over irrigated paddy fields during the start of the planting season. One reason is that chena cultivation is entirely rainfed and therefore farmers do not risk any delays in the timely

planting of the chena, whereas rice cultivation which relies on irrigated water stored up in irrigation tanks will not be affected much by slight delays. On the other hand farmers' rationale for prioritizing the chena over irrigated paddy appears to emphasize the socio-economic importance that farmers attach to the chena. First, chena cultivation offers a crop insurance against crop loss that could occur in irrigated rice farming specially during drought conditions. Second, high priced cash crops from the chena can provide a supplemental income.

Kandyan Homegardens

The origins of Sri Lanka's homegardens, or what McConnell (2003) terms 'forest gardens', are not known. However, archaeological evidence found in the forested hills of Kandy indicate that their prototypes date back to 9000–10000 BC. It is possible that their originators were the Yaksha tribe² whose members practised a form of aborigiculture (McConnell, 2003). The Kandyan homegardens generally occur in areas with high rainfall in the form of agro forest village houselots. They are most commonly found in Sri Lanka's wet zone at an elevation of 200-1000 meters in areas where the original rain forest has not been cleared for tea and rubber plantations. These garden systems are often established on non-irrigable and extremely marginal lands. They represent a land use pattern typical of Sri Lanka's central highlands widely practised in conjunction with paddy farming in many regions of the country (Everett, 1997).

These homegardens are densely planted, species-rich plots of land traditionally located around the household. Species composition and structure of the homegardens sometime vary from region to region depending on climatic conditions (Jacob and Alles, 1987). Kandyan homegardens are planned as family survival units. The general botanic architectural arrangements of the Kandyan homegardens usually display about five distinguishable layers. Appendix 4 provides examples of plant species that typically constitute the different strata of the Kandyan homegardens. The ground level contains various vegetables, condiments and root crops while the lower layer (3 -10 m) contains mostly cash crops and other edible crops. The lower middle layer (10 -15 m) consists of mostly fruit trees. The upper middle layer (15 -

² The Yakshas were the original inhabitants of Sri Lanka prior to the arrival of the ancestors of the modern Singhalese people as Indo-Aryan tribes from North India in 600 BC.

25 m) is a mixture of trees yielding fruits and other cash crops while the upper-most layer (25 - 30 m) includes palms and other tall trees (Mc Connell, 2003).

The Kandyan homegardens are highly income-diverse and the potential for further diversification exists. However, the lack of research and extension efforts to further develop this system of farming has been a setback for promoting crop and income diversity in homegardens. In fact, most extension advice to farmers in the past has been to reduce the variety of crops and concentrate on few selected crops, especially those with commercial potential. Although mixed cropping yields of homegardens appear to be low³ in comparison to mono-cropped yields, the measure of efficiency in subsistence farming rests on a different set of criteria. The objective in subsistence farming is not cash profits but household security in the form of income stability, risk avoidance⁴, flexibility, diversity of products, dispersion of products over time⁵, and sustainability (Mc Connell, 2003).

McConnell (2003) explains that the importance of Kandyan homegardens was only recognized when the impacts of the mono-cropped estate sector culminated in the late 1960s. The agribusiness engineered estate and cash crop sector coupled with various other socio-political factors displaced food production making the country highly dependent on foreign exchange to import basic food commodities. In addition to socio-economic consequences, the estate plantations contributed to rampant soil erosion especially in the steeper hill country causing alarming levels of siltation in the country's major river system. In the light of this situation, by the late 1960s the Kandyan homegardens that have been evolving in the Kandy hills for centuries began to receive recognition as a more benign and socially acceptable form of land use with potential to offer some solutions to the aforementioned issues.

Approximately 85 per cent of the respondents to Questionnaire A agreed (58 per cent) or strongly agreed (27 per cent) that the Kandyan homegarden system is a sustainable farming practice (Figure 35). As evident from certain responses there is the view that planned systems are environmentally more desirable. It was observed that: *'it is a well planned system of farming'* (RA1) and *'this does not harm the environment as it includes soil conservation and well planned cropping patterns'* (RA23). On the subject of cropping patterns, one respondent stated that *'this system is better than a mono-cropping system'* (RA4) suggesting an

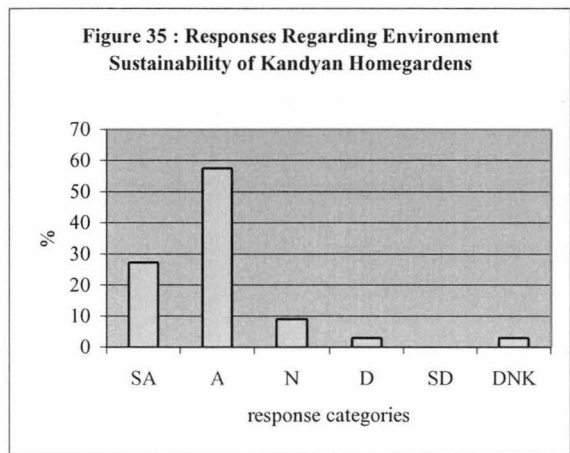
³ Typically mixed crop yields are 50-70 percent of the yields of pure stands of crop.

⁴ Whole farm productivity provides a buffer against the sub-optimal performance of individual crops.

⁵ Dispersion of products over time allows crops to be harvested as and when needed.

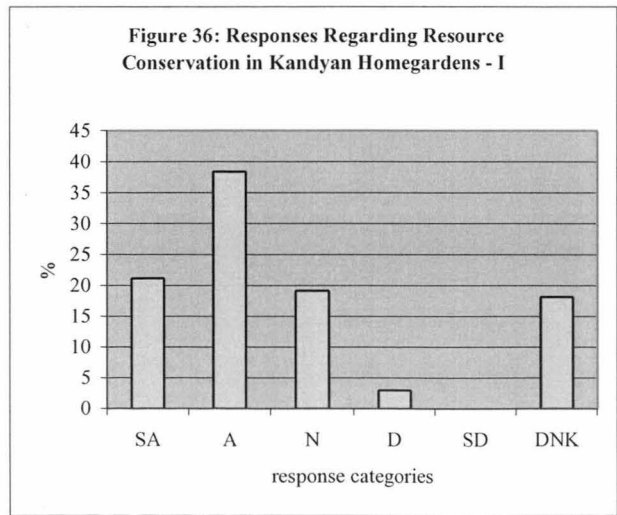
appreciation of the species diversity within this system. Being analogous to a rainforest in structure was also seen as a one of its sustainability features as corroborated by statements such as ‘the Kandyan homegarden system has the structure of a rainforest with stratification and species diversity which minimizes pest attacks and saves soil structure’ (RA27) and ‘this homegarden is like a natural forest’ (RA30). These observations suggest the respondents’ recognition of the ecological significance of mimicking natural systems:

At the heart of the agroecology strategy is the idea that an agroecosystem should mimic the functioning of local ecosystems thus exhibiting tight nutrient cycling, complex structure and enhanced biodiversity (Altieri, 2002, 8).



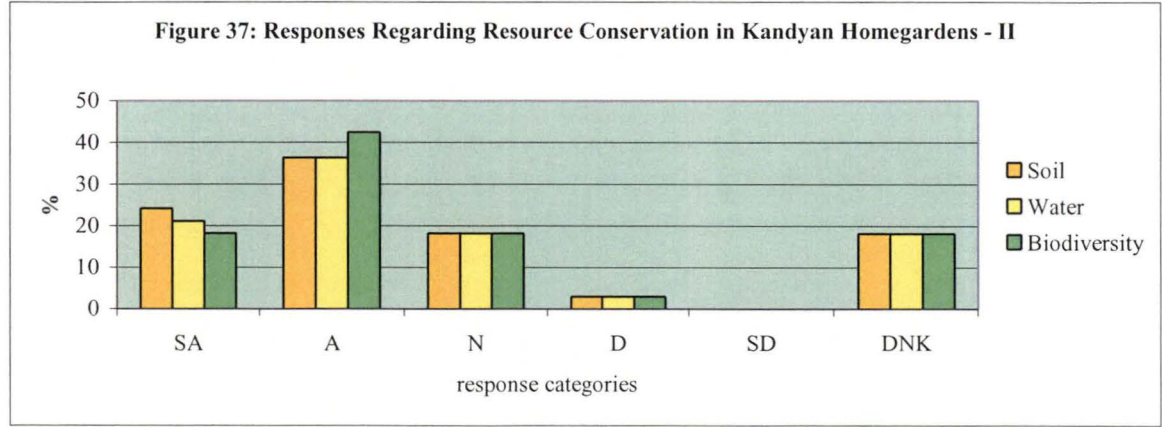
The aforementioned responses underscore the point that soil health is also an important theme among respondents, given their frequent references to the need to conserve soil and maintain its structure. Homegardens are acknowledged as creating favourable soil conditions. Banerjee (1999) explains that complex forests systems are capable of producing complex soils as exudates of forest

trees composed of proteins and sugars feed soil micro-organisms that play an important role in enhancing soil fertility and soil structure. Likewise it was also stated that the structure of the homegardens ‘minimizes soil erosion’ (RA29).

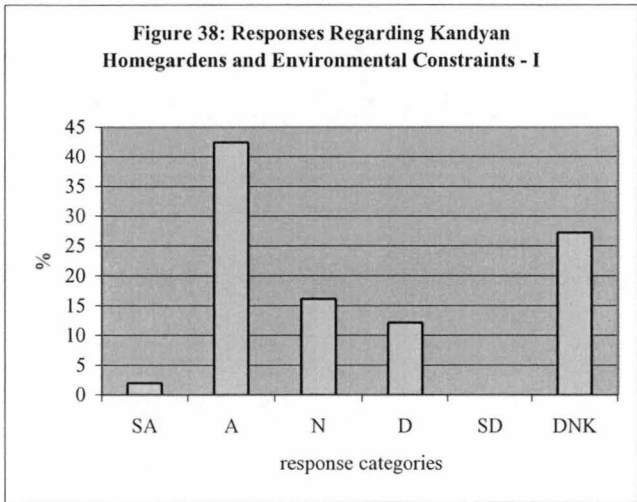


Further questioning revealed that 59 per cent of the respondents to Questionnaire A either agreed (38 per cent) or strongly agreed (21 per cent) that the Kandyan homegardens conserved local resources (Figure 36). Figure 37 provides a detailed illustration of respondents’ views on conservation of resources such as soil, water and biodiversity in Kandyan homegardens. It was frequently pointed

out that Kandyan homegardens incorporate various cultural and management practices for soil water and biodiversity conservation. This tendency is apparent in statements such as: ‘*various practices are adopted for soil conservation*’ (RA1); ‘*soil conservation is done using stone barriers and tree rows*’ (RA8); ‘*homegardens use better conserving techniques. So they do not waste water resources*’ (RA27); ‘*practices are adopted to ensure that the soil retains water*’ (RA8); and ‘*well maintained gardens preserve biodiversity as they are carefully managed*’ (RA27). Likewise, another major advantage of the Kandyan homegardens was that it provided an ideal habitat for fauna and flora, thereby enhancing biodiversity. It was observed that ‘*accumulation of biomass and also the canopy layers of foliage enables a variety of fauna and flora to thrive*’ (RA17); ‘*creates an environment that is conducive for various organisms*’ (RA19); and ‘*provides a good habitat for wildlife*’ (RA8). Being the land use system closest to the natural forest, the literature states that these homegardens proffer a number of significant biological and ecological functions. In older villages in the central highlands of Sri Lanka the homegarden canopy closure is well in excess of 70 per cent crown closure, which is the criteria for a closed canopy forest. In most of these gardens about 20 per cent of the plant species are usually native forest species resulting from seed dispersal through wind or wildlife (Everett, 1997). In addition it has been observed that wildlife diversity within these homegardens is almost comparable to the diversity found in the forest. Therefore, these homegardens provide a sanctum for the rapidly diminishing numbers of fauna and flora in the region. Since there are no distinct boundaries separating these gardens they form a continuous stretch of vegetation and fulfils most of the functions of the former forest cover such as erosion control, watershed protection or nutrient cycling (Everett, 1997; Senanayake, 1987).



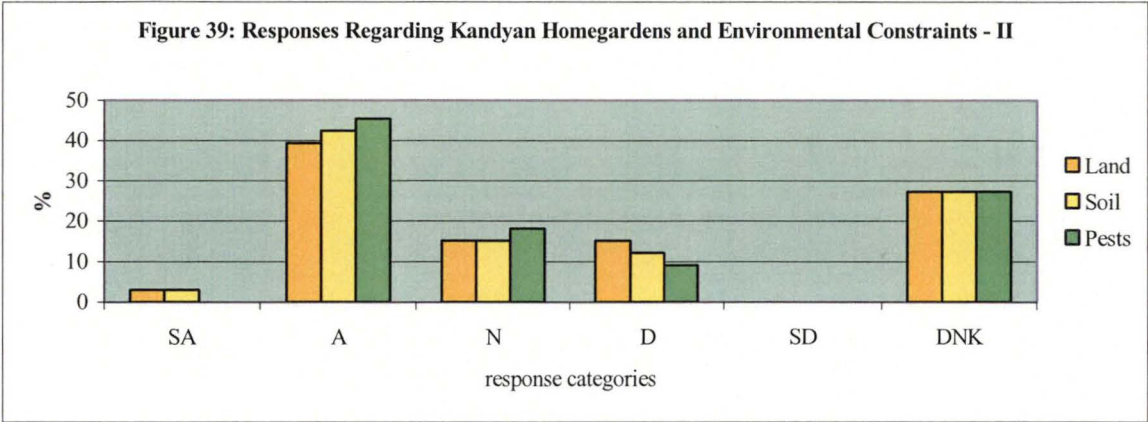
There was also the opinion that Kandyan homegardens offered other types of ecological services to the environment as indicated by observations such as ‘*protects watersheds*’ (RA23); ‘*watersheds are protected*’ (RA19); ‘*soil is protected. Prevents soil erosion*’ (RA25); and ‘*reduces soil erosion*’ (RA30).



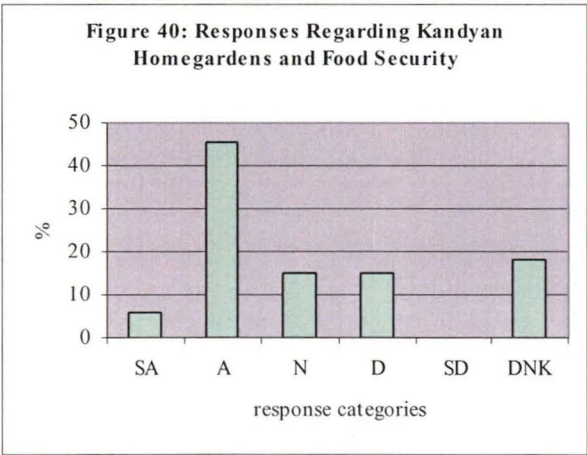
In many parts of the world most homegarden systems have evolved under the influence of various resource constraints as innovative approaches to land use (Nair, 2004). The consequent scarcity of available land and capital has pushed resource poor farmers to farm increasingly marginal environments. When asked whether the Kandyan homegarden system is well adapted to

environmental constraints such as marginal lands, marginal soils and pests about 50 per cent of the respondents to Questionnaire A agreed (41 per cent) or strongly agreed (9 per cent) on this point (Figure 38) while approximately 26 per cent of the respondents disagreed. The remaining 24 per cent indicated that they were either neutral or did not know. Figure 39 shows a detailed presentation of how respondents view adaptability of Kandyan homegardens to environmental constraints such as pests and marginal soils and land. Among those who affirmed Kandyan homegardens as being adaptive to environmental constraints it was often pointed out that the Kandyan homegardens were ‘*less susceptible to pests*’ (RA25); or ‘*pest infestations are rare*’ (RA2). It was suggested that ‘*natural pest control takes place because of biodiversity*’ (RA28); and that ‘*pest resistance is achieved through crop diversification*’ (RA23). In addition, within this group of respondents there was the general opinion that this system adopted good land use practices and soil conservation measures and as one respondent declared ‘*this system [Kandyan homegarden system] can develop land fertility. This system can develop marginal soils into fertile soils*’ (RA30). This view illustrates that the Kandyan homegardens are perceived with a certain level of optimism regarding their potential to restore degraded land and thrive in marginal environments. Such a tendency is also confirmed in the literature that soil fertility within homegardens often increases considerably overtime as

the soil continues to be enriched with the application of manures and kitchen wastes (Fresco and Hoogerbrugge, 1993).



Productivity and profitability are dominant criteria for assessing Western farm economies and as the type of farming moves toward the subsistence end of the spectrum the significance of such criteria greatly diminishes. Instead criteria such as income stability over time, sustainability, diversity and flexibility in product uses become increasingly important (McConnell, 2003). Homegardens do not exclusively focus on subsistence crops however. Their trend is to provide a combination of subsistence and cash crops (Niñez, 1984).



Nevertheless, in most cases the primary function of the homegardens is to provide food for household consumption. Continuous production takes place throughout the year. Cropping patterns with varying production cycles maturing at different times of the year ensure a relatively uninterrupted supply of food during the year. Although there are peak

and slack seasons due to climatic and other environmental factors, daily harvest of some crop is possible in most homegardens (Nair, 2004). Approximately 52 per cent of the respondents to Questionnaire A either agreed (46 per cent) or strongly agreed (6 per cent) that the Kandyan homegardens ensured year round food security to resources poor farmers (Figure 40). About 15 per cent disagreed and 33 per cent indicated that they were either neutral or did not know. Those who agreed that Kandyan homegardens provide food security emphasized

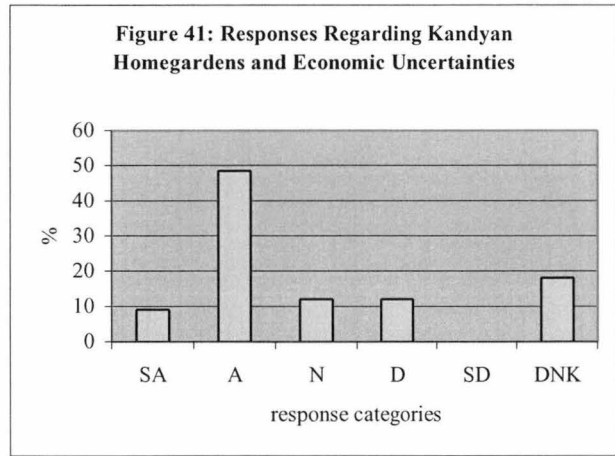
the variety of household needs that a farmer derives from this systems. This view is supported by observations such as: *'the Kandyan homegardens easily provides, food commodities, medicines and other requirements to the beneficiary'* (RA17); *'in the Kandyan homegarden system farmers can grow any [type of] crop such as cash crops, fruits, vegetables etc. So that poor farmers can maintain their day to day food security'* (RA18). It can be inferred that crop variety is perceived as a determinant of food security because it can provide food for consumption as well as a cash income that could ensure food accessibility to the farmer. This range of diversity is described by Everett (1997) as Kandyan homegardens typically containing a variety of species that provide bulk food⁶, vegetables, fruits, condiments, beverages, edible and cooking oil, medicinals, timber and other household construction materials and household fuel. These farming systems are usually designed to function as family survival units. A homegarden of about ¼ acre would often contain plant species to provide most of the basic necessities of the household and in some instances would incorporate some livestock. A homegarden garden of about ½ acres, would frequently include some type of cash crop such as pepper, cloves, nutmeg, coffee, turmeric among others, in addition to the above subsistence components. In this regard Fresco and Hoogerbrugge (1993) elaborate that the economic contribution of the homegardens to the household is twofold -- that is through cash saved on food purchases and cash earned through sale of homegarden produce.

Among the respondents there are also opinions that the Kandyan homegardens do *not* ensure food security as they tend to concentrate too much on cash crops. This view is reflected in observations such as: *'does not provide food all year round. Mostly cash crops are grown'* (RA19); *'does not provide food security all year round because this [the Kandyan homegarden system] includes cash crops and various other long-term crops'* (RA23) as well as the observation that *'production is not enough to secure food requirement of an average family'* (RA17). This tendency to favour cash cropping may be an indication that homegardens are evolving towards more commercialised enterprises as all land use patterns often reflect changing responses of farmers to changing circumstances (Fresco and Hoogerbrugge, 1993). However, some respondents argue that food security is jeopardised where food crops compete with cash crops or where farmers cannot allocate enough resources to grow sufficient food crops for domestic consumption. This perception differs from those

⁶ These include jak, breadfruit, plantains, yams, cassava, sweet potatoes etc.

who see cash crops as being able to ensure the farmer with a cash income thereby providing him accessibility to purchasable food items.

This disparity in attitude about the role of cash crops that are grown within the homegardens could be due to differences in discourses on how these two groups of respondents interpret the concept of food security. According to McConnell (2003) one generally prevalent perception is that homegardens are a backward and inefficient form of farming based on the western models of productivity. Yet some analysts have observed that based on per unit of land and per unit of labour, homegardens are more productive than other farm types. This has been difficult to substantiate as it is not feasible to aggregate the different economic productivity measures⁷ of diverse products into one single quantitative measure. If however, all these are to be expressed in terms of ecological measures of net primary production (NPP) it is safe to conclude that homegardens are highly productive agroecosystems since they mimic the most productive natural terrestrial ecosystem -- the rainforest.



According to Nair (2004), homegardens provide mostly for household consumptions but any marketable surplus can provide some income security to the farmer during crop failures in rice paddy and during intervals between the harvesting seasons of rice paddy when the farmer has no other means of income. Approximately 58 per cent of the

respondents to Questionnaire A either agreed or strongly agreed that the Kandyan homegardens provided relief to poor farmers during periods of economic difficulty (Figure 41). About 12 per cent disagreed on this point while about 30 per cent of the respondents indicated that they were neutral or did not know. It was pointed out that ‘*although this [homegardens] does not provide food security, indirectly it provides economic benefits*’ (RA23). However, another respondent observed ‘*[this is possible] sometimes only. Average production from Kandyan homegardens is not enough to meet requirements*’ (RA16). There is the belief that Kandyan homegardens provide farmers limited economic relief. However, it

⁷ The multitude of species and the diverse products obtained from these such as food, medicine, beverages, building material must be measured using several different quantitative measures such as kg/tree, kg/ha, number of fruits, bunches, bottles of sap, sheets of rubber, boxes of mace etc.

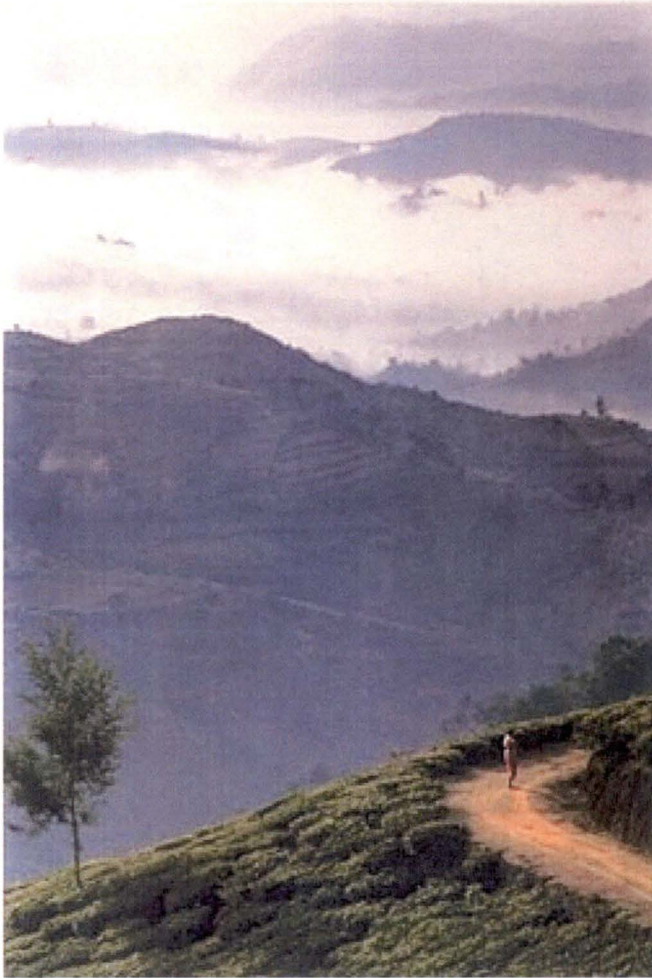
was also noted that *'this involves less risk'* (RA25) and *'there is less risk here and it provides more assurance to the farmer'* (RA28). This observation quite possibly suggests that Kandyan homegardens are perceived as a potential economic safety net despite notions of low productivity and profitability. Among those who acknowledged the economic significance of the Kandyan homegardens, crop variety is seen as a definite plus point within this system as can be understood from the view that *'[It] produces various food crops and spices. This system of farming is useful to the farmer'* (RA1). Kandyan homegardens are also perceived as a response to economic necessity as can be inferred from the observation that *'If poor farmers do not have any economic relief farmers automatically turn to Kandyan homegarden system because there is no need to use manure, high quality seeds et cetera'* (RA18).

Summary

Respondents' attitudes concerning the environmental aspects of chena cultivation appears to moderately favour certain ecological advantages given that it is carried out with sufficient lengths of fallow periods. However, socio-economic benefits of chena cultivation are frequently acknowledged. Yet, in the face of current resource constraints, there is the general assumption that chena cultivation needs to be stabilized. A perceived lack of alternatives to chena cultivation appears to have compelled most respondents to support this idea while being somewhat sceptical regarding the success of stabilized chena farming as the concept itself holds inherent contradictions. There were also divided views on the resource-conserving attributes of chena farming. Both view points appear to be valid as they may be understood through vastly different discourses on impact of chena farming. This difference could be owing to the fact that traditional chena farmers who adopt conservation practices and migrant chena farmers who lack such knowledge impact the environment quite differently. Tradition appeared to be a predominant theme, especially in reference to chena cultivation and its environmental impacts.

Respondents perceived Kandyan homegardens in a less contentious light. There was a high level of agreement regarding its ecological soundness. Management practices within Kandyan homegardens were considered as highly favourable for resource conservation. It was perceived that a farming system, which mimics a natural system provides a range of biophysical advantages to the ecosystem. Although its ability to provide food accessibility to the farmers was acknowledged there were concerns by some respondents that Kandyan

homegardens concentrated on growing cash crops at the expense of food production. This view possibly indicates a concern regarding Kandyan homegardens transforming into agribusiness-engineered farming systems, which could quite easily overlook the needs of small farmers.



Chapter 6

Respondents' Perceptions on Institutional Issues

Photo: Luke Powell, 1996
Photo: Luke Powell, 1996

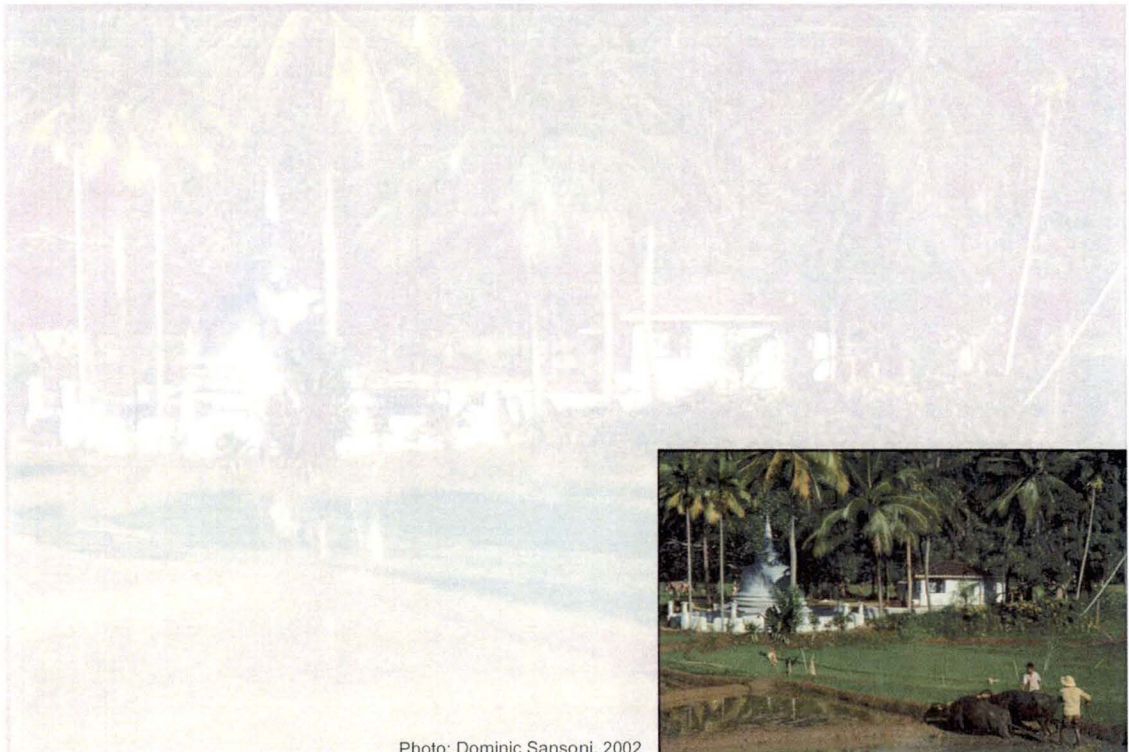


Photo: Dominic Sansoni, 2002

CHAPTER 6

Respondents' Perceptions on Institutional Issues

I devote this chapter to an exploration of respondents' views on Sri Lanka's existing policy framework and the manner in which it influences sustainable agriculture there. I rely on the discourses of agricultural professionals and, to a lesser extent, on the discourses of administrative officials in order to gain an understanding of perspective on the existing policy environment and the institutional structures that underpin it.

The pivotal role of institutions in directing environmental outcomes of human activities is important in the task of understanding the interplay between society and the environment at various levels (Adger, 2000). The literature describes institutions as collective arrangements composed of various conventions and entitlements that have evolved within societies and that define individual and group behaviour (Veeman and Politylo, 2003). The concept of institutions can extend from social and cultural norms to formal organizations of the state and political structure. The institutions of the state, market and civil society play a definitive role in issues related to social vulnerability, environmental outcomes and resource allocation (Adger, 2000). Institutions are therefore social decision systems that establish rules of a society or organization for resource use as well as the distribution of resultant benefits. They formalise and normalise transactions among parties to reduce uncertainties and provide structure to economic relations (Veeman and Politylo, 2003).

On the subject of policy, according to Adger *et al.* (2002), policy is the result of a series of decisions regarding the identification of a problem, possible solutions and strategies to implement a preferred solution. More comprehensively, the policy-making process consists of identification of the issue, defining context, options or solutions, assessment of options, selection of the most appropriate option(s), monitoring and evaluation of implementation processes, learning or feedback for future policy formulation, and attaining increased levels of efficiency and effectiveness.

Social and institutional conditions that support policies for sustainable agriculture are not well understood. However, some understanding in this area has been established with respect to

circumstances that are associated with local level community participation and innovative partnerships between external agencies in development activities. Yet, the political conditions conducive to the expansion of policies that support sustainable agriculture, are understood to a much lesser degree (Pretty and Hine, 2001).

In many places the progress of sustainable agriculture in the past decade has taken place regardless of existing policy frameworks. In other words farmers have received no support or encouragement for adopting or reinstating sustainable agriculture from governments. Most policy frameworks are primarily designed to address intensified food production. However, they will need to deliver environmental and social benefits, and respond to calls for significant reforms. Rural policies and institutions that promote 'exogenous' measures for social and economic issues of rural societies are also ill-equipped and are in need of transformation (Pretty, 2004). The major challenge in achieving sustainable agriculture lies in policy formulation. The trouble with traditional approaches to agricultural policy formulation is that they rely on a degree of coercion and control, and are suited to simplistic and predictable systems, whereas the complex nature of sustainable agriculture requires a policy approach that is more empowering and reliant on local resources and knowledge (Pretty, 1995).

Veeman and Politylo (2003) identify four critical components for sustainable development, which include: (a) institutions, (b) growth¹, (c) distribution² and (d) the environment³. The institutional component is essential to address issues of participation and empowerment within the development process, and to ensure widespread participation of communities particularly disadvantaged or marginalized groups. Considering the crucial role of institutions, one of the aspects that this study emphasizes is the significance of various institutional perspectives of agricultural policy underpinning the institutional landscape within Sri Lanka's agriculture sector. In the context of the study, marginalized groups are the resource poor farmers who rely on subsistence agriculture in Sri Lanka. The question posed to administrative officials and agricultural professionals was: *Should resource poor farmers be encouraged to adopt traditional farming systems such as chena cultivation and the Kandyan*

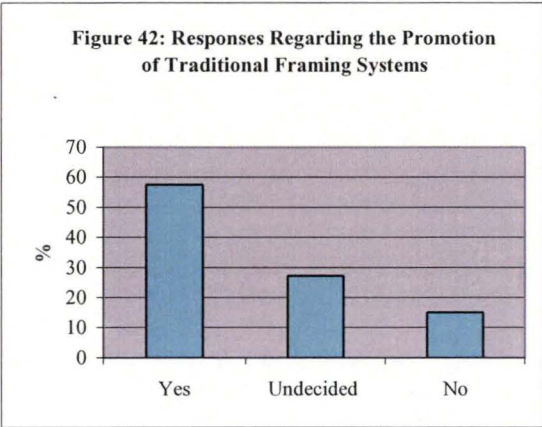
¹ The growth component relates to expanding productive capacity. Economic growth is a necessary but not a sufficient condition for overall development. How the benefits of growth are distributed must also be taken into account (Veeman and Politylo, 2003).

² The distribution component is concerned with issues of equity within any generation, as well as issues of equity between current and future generations (Veeman and Politylo, 2003).

³ The environmental component is concerned with ecological consequences of economic activity as well as being closely linked to issues of intergenerational equity (Veeman and Politylo, 2003).

homegarden system? As illustrated in the following sections the responses were diverse, indicating a great range of ideas and opinions about the institutional aspects of chena cultivation and Kandyan homegardens.

Traditional Farming Systems and Resource Poor Farmers



When administrative officials were asked whether traditional farming practices such as chena and the Kandyan homegardens should be encouraged to address the needs of poor farmers, about 58 per cent of the respondents to Questionnaire A agreed that these systems should be supported while about 15 per cent objected to this idea (Figure 42). The remainder (about 27 per cent) was undecided on this issue.

Those who agreed that traditional farming systems should be encouraged pointed out a variety of reasons why these systems should be allowed to continue.

One agricultural professional who is in favour of promoting traditional systems defended his position as follows: *‘Chena cultivation has been an age old practice throughout the humid and dry tropics, in many parts of the world. Its age old practice has prompted many western agricultural experts to label it as a primitive form of subsistence farming. The above is not even half the truth. Throughout the ages a vast sea of agricultural knowledge has been acquired, the validity of which cannot be brushed aside. The need is there to take the valid essence of such practices and to combine with modern scientific knowledge ... With regard to Kandyan homegardens resource poor farmers have to be encouraged to keep the Kandyan homegardens. Vegetation on the hill slopes can prevent soil erosion, landslides and clogging of waterways, which would otherwise lead to flooding and destruction of life and property. Hence Kandyan homegardens have to be strictly adhered to, to prevent farming and settlement destruction in the hill country’* (RB6).

Compared to modern agriculture, traditional systems are seen to pose fewer health risks from chemical contamination, as reflected in statements such as *‘for a healthy population food must be produced without the use of poisonous substances [agro-chemicals]’* (RA1) and *‘food*

grown according to traditional ways is healthy. There is no dependence on agriculture, which relies on chemical inputs' (RA9). Clearly, agriculture that depends on chemicals is viewed as problematic for health reasons. Those directly involved in the farming sector seem to be exposed to the highest levels of risk in pesticide poisoning more often than the consumer (Eddleston *et al.*, 2002). According to estimates by the World Health Organization (WHO), three million pesticide poisoning cases occur every year with 220,000 deaths worldwide. This problem is particularly severe in Sri Lanka as pesticide poisoning is the sixth commonest cause of death at the national level while in six rural districts pesticide poisoning is reported to be the main cause of death. While the majority of the cases are due to self-poisoning⁴ the risks of occupational and accidental poisoning cannot be ignored. Occupational illness is a common problem because farmers find it impractical and costly to use safety equipment in the humid tropics. Likewise, safety instructions on pesticide labels are overlooked because these may be written in unfamiliar languages or farmers may be illiterate and the instructions themselves are not practical to follow (Eddleston *et al.*, 2002).

The ability of traditional systems to be responsive to the needs of poor farmers is also highlighted. These systems are favoured over modernized farming as evident from the response: *'farmers' needs are not considered in commercial farming systems which rely on non-renewable energy, machinery and chemical inputs. They are managed according to the likes and dislikes of multinational corporations'* (RA9). Farmers are forced to rely on expensive machinery and farm chemicals that cause a cost-price squeeze for farmers. As a result small-scale farming has become unprofitable and have driven millions of farmers to dire economic circumstances as agribusiness companies manage to expand their control. Corporate food systems are therefore not capable of responding to farmers' or environmental needs (Rosset, 2000). Along this line of thinking, traditional systems are viewed as more appropriate to address the needs of subsistence farmers. In particular the chena cultivation system is seen as an important means of survival for resource poor farmers. It is observed that *'the main form of farming for the resource poor farmers is the chena cultivation system. Because of poverty they are unable to adopt more commercialised agriculture'* (RA10); *'chena cultivation provides sustenance for the resource poor farmer'* (RA14); and *'resource poor farmers heavily depend on chena cultivation for their food than any other farming system'* (RA13).

⁴ In 1995 it was reported that suicide, by using agrochemicals was the main cause of death nationally in the 15–24 and 25–49 year age-groups in Sri Lanka (Eddleston *et al.*, 2002).

As a means of risk minimisation, traditional systems also seem to play a significant role among resource poor farmers and appear to be an important consideration for promoting traditional systems. One agricultural professional elaborates as follows: *'To adopt modern farming methods farmers need money. On the other hand modern farming technologies involve more risk of crop failure due to adverse effects of weather, pest and disease et cetera. All these unfavourable conditions cannot be borne by resource poor farmers. They cannot afford such technologies. So we should encourage such farmers to adopt traditional farming systems but there should be a continuous process to develop these technologies under government supervision to improve productivity of these systems as well as to look after the adverse environmental effects of these systems if any'* (RB1). In fact, Reijntjes *et al.* (1992) point out that in traditional systems there is greater emphasis on reducing risk than on maximizing production. The selection of pest resistant varieties, maintenance of biodiversity, polycultures, crop and livestock mixtures are characteristic of these systems as risk minimization strategies.

Another socio-economic benefit of traditional farming systems identified by some respondents was food security for the farmer, as supported by statements such as *'farmers are assured of their food security'* (RA29) *'in times of food shortages they [farmers] have experienced extreme difficulties when they did not have traditional varieties of cereals for consumption'* (RA13). Likewise, traditional systems are seen as a means of crop insurance against failures of the main crop as explained by one respondent that *'If main crop fails they [farmers] have an alternate way to obtain an income'* (RA20). As Tennakoon (1986) explains, this tendency is particularly true of chena cultivation. Farmers even go to the extent of prioritising the rainfed chena over paddy cultivation as a form of crop insurance against losses in irrigated paddy during drought conditions, because the chena has a better chance of surviving under such conditions. Traditional varieties play a significant role in risk reduction but many of these are rapidly being forfeited. Therefore traditional agriculture is also viewed as an important means of arresting the loss of traditional varieties as pointed out by one respondent that *'due to most Green Revolution crop varieties introduced in the 1960s most traditional varieties are disappearing. Therefore traditional farming which cultivates various traditional crop varieties must be preserved'* (RA13).

Overall, traditional farming systems are perceived as having safety features (chemical free food, and preservation of crop variety) and security aspects (survival for poor farmers, food security and crop insurance) that warrant their continuation. However, among those who supported traditional farming systems a considerable number of respondents emphasized the need to adopt these systems with improvements, modifications or innovations to suit present conditions. For example it is observed that *'This [chena cultivation] should be modified to suit present conditions'* (RA14); *'since these [traditional] farming practices are carried out in limiting environments it is important to provide farmers with new knowledge and technology'* (RA26); and *'suitable new technology should be introduced to bring out the positive attributes of traditional farming methods'* (RA28). These observations suggest that there is a view that traditional systems are more beneficial if they are revamped to suit present day conditions. With regard to technology innovations, Altieri (2002) states that since most subsistence farmers live in highly heterogeneous and risk-prone environments they may not benefit from mainstream technologies. Yet demand-driven technologies -- that is technologies which cater to diverse local conditions and socio-economic needs based on local knowledge and resources can -- be considered appropriate. Altieri (2002) also cautions that focus should be on improving the whole farming system at the field or watershed level than on concentrating on the yield increases of specific crops.

Among administrative officials who were not in favour of the promotion of traditional farming systems, the most commonly cited reasons were concerns about environmental and resource degradation, population pressures and the need for alternatives. For example, statements such as *'if this [traditional farming] is encouraged there will be more damage to the environment'* (RA3); and *'traditional systems are harmful to the environment'* (RA11) illustrate such concerns. A need for alternatives is stressed as follows: *'there is no land for chena cultivation. Land to man ratio is a problem. We need alternatives'* (RA30). However, the respondents within this group did not specify preferred alternatives. One agricultural professional pointed out similar shortcomings with the chena cultivation as follows: *'Resource poor farmers should not be encouraged to adopt traditional farming systems [such] as chena cultivation because this system leads to deterioration of environment especially in the hill country. Also presently chena cultivation is practised at the subsistence level and it is not sustainable'* (RB2). However the same respondent was in favour of the Kandyan homegardens and elaborated that: *'Resource poor farmers should be encouraged to adopt traditional farming systems [such] as Kandyan homegardens especially in the hill*

country, because they are conducive for watershed management and generate income throughout the year' (RB2). Land degradation appears to be the major issue associated with chena cultivation. Redclift (1990) argues that poor land management is not just a physical problem requiring a technical solution. It is the result of a combination of economic, social and political factors, which determine land use practices. Therefore it is necessary to understand *why* undesirable land use practices are carried out. Without understanding the underlying causes, it may not be possible to propose appropriate alternatives.

Policy Constraints

Another question put to the agricultural professionals was as follows: *What elements in agriculture policy constrain traditional farming systems such as chena cultivation and the Kandyan homegarden system?* Policies pertaining to extension support, plant materials, traditional knowledge, bureaucracy, forest clearing, modern technologies, research priorities, import liberalization, and soil conservation issues were identified as posing certain restraints to traditional forms of agriculture by the respondents.

The prime focus of Sri Lanka's agricultural policy is irrigated agriculture and therefore rainfed systems such as chena cultivation are sidetracked and given little attention by the Department of Agriculture as one respondent elaborates. '*Since food security is a prime concern and the bulk of food production comes from irrigated farming and [since] both irrigated farming activities and chena cultivation fall more or less during the two seasons (Maha and Yala), it is always the irrigated paddy that is kept as the focus of agricultural administration. In the process, chena cultivation generally goes out of the view screen of the department of agriculture. It is left entirely to the chena farmers often and extension support, seed / plant material, is scantily made available once the sowing of irrigated paddy fields is over*' (RB6).

Likewise, it is also pointed out that agriculture policy puts more weight on promoting modern technologies. Farmers who are financially able and have access to sufficient facilities, manage to benefit from modernized farming, while resource poor farmers face further marginalisation as one respondent explains. '*Promotion of modern technology (by giving subsidies etc.) has increased the agricultural productivity in resource rich areas where transport irrigation and*

other facilities are available and they get reasonable price too for their products. But resource poor farmers cannot get such' (RB1).

Government restrictions on forest clearing are seen as a limiting factor in chena cultivation. The respondents point out that *'ban on opening up new forestland for chena cultivation'* (RB2) and that *'protecting natural forest cover by not issuing permits to undertake chena in such demarcated areas'* (RB5) restrain chena cultivation. Similarly, another legislative hurdle for traditional farming such as chena cultivation is the Soil Conservation Act, which as one respondent succinctly stated, *'... does not encourage chena cultivation'* (RB1). In the interest of soil conservation, the Soil Conservation Act has provisions for prohibiting vegetation clearance as well as provisions for restricting and controlling the use of land for agricultural or pastoral purposes if an area is considered to be vulnerable to erosion (Batagoda, 2004). Since chena is perceived to contribute to soil erosion (see discussion in Chapter 5) provisions of the Soil Conservation Act becomes applicable to chena cultivation.

The current manner in which extension services are delivered to farmers by the government has little benefit for traditional farming as explained by one respondent. *'Until the mid 1980s there was greater concentration in all agricultural policies to maintain a strong wing of extension services. There was a separate department of extension in the Agriculture Ministry. Disbanding this and handing over to district agriculture directors has diluted the significance and effectiveness of extension services. At district level the focus has often been on maintaining experimental farms on certain locations as opposed to earlier system where there was a line of operators and extension services at national, provincial, district and village levels. The village level extension officer was required to live in the village and carry out extension services in individual farms (irrigated or highland agriculture) directly imparting extension knowledge. It also had the transfer and verification system built into it. There was a consistent supervision of field situations'* (RB6). The new system of extension services appears to provide a generalized service at the district level and much less localized supervision at the farm level on case-by-case basis. Since traditional farming practices are based on location specific conditions (Altieri, 2002) it is possible that district level model farms offer very little extension support to traditional agriculture. Another apparent handicap is that there are few research and development efforts targeted towards improving traditional farming systems. One respondent explained that *'[there are] no research priorities to develop traditional farming systems. Present research policies are mainly focused on improving*

modern technologies; less [focused] on traditional farming systems. Farmers who cultivate chena and homegardens still use very traditional practices. So there are no productivity improvements in such systems' (RB1). Just as research may be lacking in this area, this statement also suggests a fixation with the idea of 'increasing productivity', which may be the base of the problem. Such thinking seems to run counter to the aims of traditional systems because the main objective of these systems is not short-term productivity improvement of a target crop. These systems are more inclined towards risk reduction and long-term resource management (Reijntjes *et al.*, 1992). Therefore, there appears to be some bureaucratic bias regarding what issues need to be addressed through research. Furthermore, the lack of interest in traditional systems, and the tendency to brush aside traditional practices (specially by the Irrigation Department) is articulated by one respondent as follows: *'the irrigation bureaucracy is the hardest to penetrate to get to those bureaucrats to formally consider traditional knowledge that can be used with modern scientific knowledge. Sri Lanka has over 3000 years of dry and irrigated farming. But modern irrigators as well as agricultural scientists are still shy to draw lessons from these'* (RB6).

Trade liberalization policies are also seen as contributing to the demise of most traditional crop varieties, as one respondent explained, *'With the import liberalization policy, traditional value for the local coarse grains (maize, millet etc.) and grain legumes (green gram, black gram etc.) were reduced. So farmers who grow such crops have given up such cultivations'* (RB1).

Policy Support

Agricultural professionals were also asked: *What elements in agriculture policy support traditional farming systems such as chena cultivation and the Kandyan homegarden system?* As discussed in detail in the following sections, respondents pointed out that support for organic agriculture, partnerships with local level institutions, promotion of stabilized forms of highland farming, support for export crops and leniency in land clearance restrictions has directly or indirectly benefited traditional agricultural practices.

In general, government policy for promoting organic agriculture encourages a supportive atmosphere for traditional farming practices as one respondent pointed out: *'organic agriculture policy of the government supports traditional farming systems such as chena*

cultivation and the Kandyan homegarden system' (RB2). In addition, one respondent observed that *'NGO involvement in development of traditional farming systems has helped resource poor farmers to look at their farming from a new angle'* (RB1), suggesting that partnerships with local institutions such as NGOs can provide significant support for traditional farming practices.

However, it is evident from the responses that agricultural policy does not offer direct support to chena cultivation but promotes stabilized highland farming instead. One respondent quite explicitly stated that *'Agriculture policy does not encourage chena system but encourages dryland systems of traditional farming through semi established highland farming systems'* (RB5), which clearly illustrates a policy drive to transform chena cultivation into stabilized systems. This transformation is further reinforced and actively promoted through the extension policy as one respondent explained. *'Most of the extension services launched during the past decade are geared to chena form of cultivation transforming into stabilized highland farming. These [practices being promoted] include (a) minimum tillage; (b) mulching; (c) ridging; (d) soak pit construction; (e) introduction of hybrid varieties; (f) mixed planting of moisture loving crops and drought resistant crops; (g) soil and water conservation; (h) rain water harvesting and drip irrigation'* (RB6). In addition, stabilized highland agriculture is even given financial backing as evident from the observation that *'the government through state banks and even with the persuasion of private banks have several loan schemes for stabilized highland farms or as a crop-by-crop basis on easy repayment and interest payment rate'* (RB6). Farmers engaged in stabilized farming also receive marketing support and are protected by a pricing policy as illustrated in the following account. *'The government as a part of its agricultural policy have established minimum floor prices to an array of chena crops...marketing support during the harvesting season [is provided] in addition to allowing private buyers to buy produce. Government machineries such as the co-operatives department enter into competition buying with private buyers just to ensure fair prices to the commodity producers and sellers at the farm gate'* (RB6). These observations undoubtedly illustrate much policy support for stabilization of shifting cultivation.

Cairns and Garrity (1999) observe that, notwithstanding the debates on the merits and demerits of shifting cultivation, there is growing concern about the environmental and human consequences of unchecked shifting cultivation due to increasing population densities and heightening land use pressure. Although this problem has intensified attempts to establish

more sedentary forms of land use and stabilized farming systems through purely technical approaches these have not been highly successful. According to Cairns and Garrity (1999) what is required is a range of more productive shifting cultivation systems. There have been many examples that illustrate the ability of shifting cultivators to effectively manage local resources and devise solutions to local problems. Farmers' rejection of research driven technocratic approaches to stabilization of shifting cultivation has promoted greater understanding of the constraints that they face in the transition from shifting to stabilized farming. Therefore, Cairns and Garrity (1999) propose participatory on-farm research approaches in order to generate solutions. They recommend that this approach should incorporate processes to identify, document, and evaluate the validity of promising indigenous practices and mechanisms for technology transfer to other locations, verification and wide-scale extension.

In contrast to the indifferent attitude towards chena cultivation, Kandyan homegardens have received a high level of acceptance and policy support as one respondent elaborated. *'Agriculture Department, Land Settlement Department and Plantation Ministry extend full support and policy strengths to the maintenance of Kandyan homegardens which is vital to protect soils, slopes and water resources. In fact the Mahaweli Authority of Sri Lanka is developing comprehensive river basin management plans with due recognition given to Kandyan homegardens land use on the valley slopes of the Mahaweli river and its tributaries'* (RB6).

Nevertheless, although chena cultivation has never received any direct policy support, there seems to be a great deal of empathy from administrators towards the plight of subsistence farmers whose livelihoods depend on traditional chena cultivation. One respondent notes that despite some quite restrictive policy directives concerning land clearance *'agricultural administrators, being well aware of the dependence of resource poor farmers on chena cultivation, have been always restrained in bringing controls or restrictions to chena cultivation'* (RB6). In fact, the silent permissiveness of the authorities towards chena cultivation is clearly illustrated in the following account given by a respondent. *'The "grow more food policy" is a part of the agricultural policy for the past 50 years. It was only in 1985 that Sri Lanka was almost self sufficient in food. All along the way food shortages had to be covered with imports. Every time there was a food shortage chena cultivation has come to the rescue. Hence agriculture policy has not clearly opposed chena cultivation. It only*

attempted from time to time, to restrict it by using chena clearance permits. It was neither strictly implemented by the authorities nor adhered to by the chena cultivators. Chena cultivation continued virtually unchecked, authorities turning a blind eye to it. This modus operandi itself is a policy support. When during the early 1970s, the government faced severe budgetary constraints and was compelled to do away with importing crops that can be grown in the country (e.g. chillies) the indirect support of the agricultural policy was making chena permit issuance ineffective. In fact, agriculture propaganda and extension machinery loudly and openly promoted growing "any food in any land available". As such, irrigated land extent at that time being limited, cultivation of food and import substitution food items in chena lands was silently encouraged. This has enabled Sri Lanka to escape a near-famine situation whereas many African countries in particular faced actual famines during the early 1970s despite FAO's advance warning' (RB6).

In contrast, the authorities have taken more overt measures in supporting Kandyan homegardens. Government policies on developing export crops appear to lend much support to Kandyan homegardens as evident from statements such as '*Department of Export agriculture has introduced a subsidy scheme for minor export crops such as coffee, pepper etc.*' (RB2) and '*government subsidy and loan scheme on coconut, export crops like cocoa, nutmeg, cinnamon, cloves etc, fruits like mango, banana, rabutang have been immensely helpful for developing Kandyan forest type gardens*' (RB1). In fact poverty reduction schemes further reinforce the development of export crops as explained by one respondent that '*poverty reduction is aimed notably through the expansion of minor export crops. In fact a separate department has been created within the agriculture ministry to boost export crop development.*' (RB6). All such measures invariably support the expansion of Kandyan homegarden systems as most of them concentrate on growing cash crops. Yet, the idea that agricultural exports will be a major source of poverty reduction in economically disadvantaged areas, is a contestable one according to the analytic literature. Although economists may argue that exports crops are a solution to poverty reduction non-economists take the stance that cash crops can compete with food crops and can be a potential threat to food security. Berry (2001, 139) elaborates relevant policy implications and possible pitfalls of this strategy as follows:

Policy can influence the impact of agricultural trade expansion. Market forces alone will pull some small producers of labour-intensive items into export activities and

keep them there, but it is likely that in many other cases this will happen only when appropriate complementary investments are undertaken and impeding red-tape removed. One of the barriers to success may lie in the belief that rising exports *per se* are seen as “the solution” to a country’s problems. Agricultural exports may lower poverty if there is wide participation in their production; but a *laissez faire* approach in a country where public policy inertia tends to favour the rich could easily lead to the opposite outcome. One tricky aspect of policy lies in the fact that, though clear signals of what is profitable are needed to induce people and investment into the activities in question, the same clear signals can also induce theft, takeover of public policy and marginalisation of the weak.

Therefore, it is possible that a purely profit driven agribusiness engineered approach to developing the cash crop industry may well offer little benefit to small farmers.

Summary

The analysis of respondents’ attitudes to policy components of agroecological farming systems in Sri Lanka revealed that the majority were in favour of promoting chena cultivation and Kandyan homegardens. Benefits of these traditional systems that were highlighted by respondents were noted: that these systems are responsive to the needs of poor farmers unlike modern methods; posed a lower degree of health risks; and proffered benefits such as food security and crop insurance against losses in irrigated farming. However, there was emphasis on the need to adopt these systems with improvements, modifications or innovations to suit the current situation.

Respondents identified several policy constraints for traditional farming systems. It was pointed out that in general, the current agriculture policy is focused on irrigated agriculture, while rainfed systems remain on the periphery of the policy agenda. Government policies related to forest clearing, in particular restrict chena cultivation. The manner in which extension services are delivered has little benefit for traditional agriculture, while research priorities at the bureaucratic level appear to be biased -- dismissive of drawing lessons from traditional farming practices. In addition, trade liberalization policies are seen as being responsible for displacing the value of many traditional crop varieties.

On the other hand respondents also pointed out features of the policy framework that are supportive of traditional systems. The policy on organic agriculture is considered to support traditional farming practices. Although chena farming receives no direct support there appears to be some policy assistance for stabilized highland farming. However, the attitude of silent tolerance towards chena farming, adopted by the authorities in itself has created a condoning policy atmosphere for this mode of farming. Kandyan homegardens on the other hand enjoy a much better degree of policy backing, owing to its potential for developing the cash crop sector and its uncontested ecological benefits.

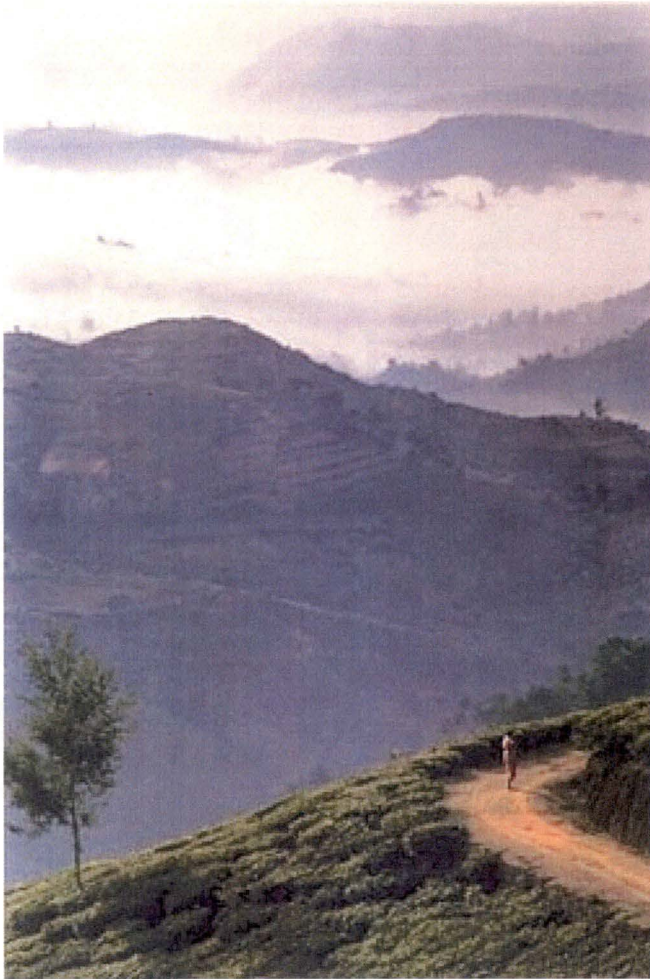


Photo: Luke Powell, 1996

Chapter 7

Summary and Conclusions

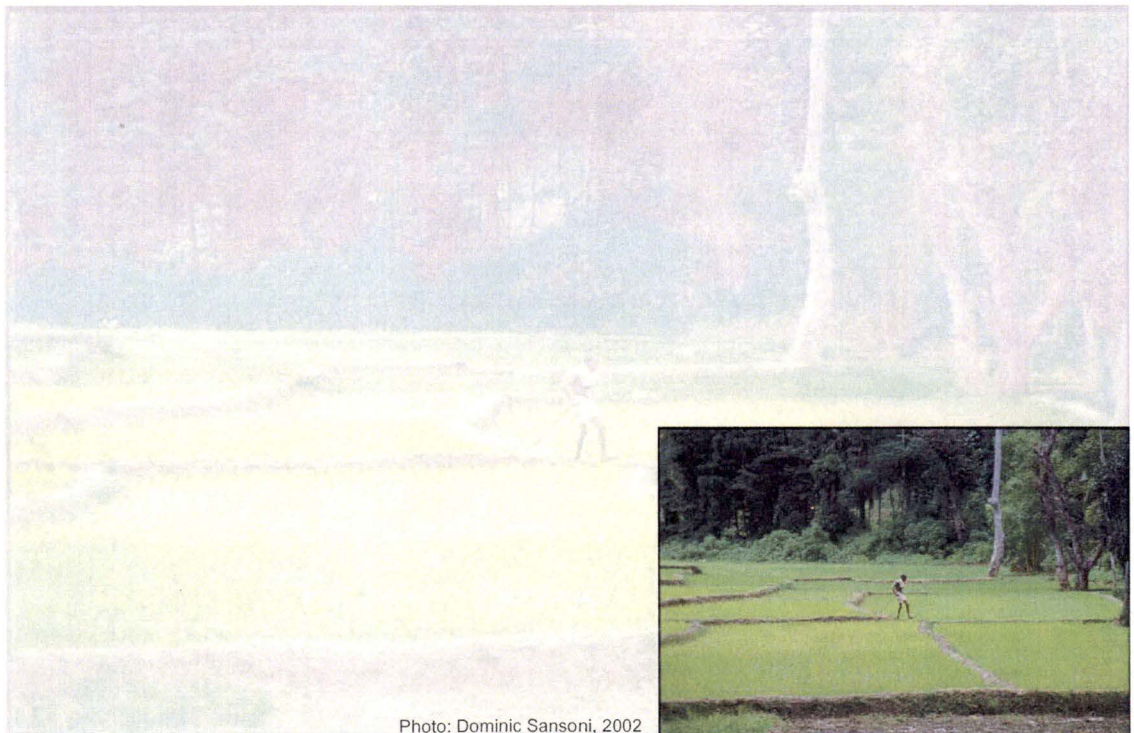


Photo: Dominic Sansoni, 2002

CHAPTER 7

Summary and Conclusions

In fulfilling my research aim to explore a range of institutional perspectives relating to agroecological farming systems in Sri Lanka, I have sought to examine some of the underlying values, beliefs and ideas held by administrative officials and agricultural professionals in relation to chena cultivation and Kandyan homegardens. Since discourse is a shared way of perceiving the world and since the main task of discourse analysis is to comprehend the content of what is being communicated (Butteriss *et al.*, 2001), I have employed discourse analysis to distil meanings embedded in the participants' views of the aforementioned farming systems. The significance of the study pertains to resource management as the manner in which people conceive their reality, directly shapes political dynamics that unfold and the ways in which resources are managed (Howitt, 2001).

About 2 billion people the world over are faced with food insecurity. Threats to food security and productivity of agroecosystems are manifold. Technologies developed during the 1960s to revolutionize agriculture is considered one factor that has contributed to the increasing vulnerability of agroecosystems. Therefore, farming practices that are ecologically responsive and based on farmers' knowledge and use of the environment are being considered as potential solutions to food insecurity (Nierenberg and Halweil, 2005). In this study I have focussed on two such farming systems specific to Sri Lanka, namely chena cultivation and the Kandyan homegardens. These two systems fall within the general category of agroecological farming systems, which in turn lie within the greater domain of sustainable agriculture. I therefore structured my inquiry under four sub-sections namely: sustainable agriculture (chapter 3); agroecological production systems (chapter 4); chena cultivation and Kandyan homegardens (chapter 5); and institutional matters (chapter 6). To guide my interpretations I engaged in multiple readings of the participants' responses and analysed their texts within a discursive framework (McKenna, 2004) that values an ecologically sound, socially just, economically viable and culturally appropriate agricultural paradigm.

In general, respondents' perceptions of sustainable agriculture most commonly revolved around themes such as agricultural practices, environmental effects, and socio-economic

goals. Respondents' definitions of sustainable agriculture brought three matters into focus. First, sustainable agriculture was perceived as a set of *practices* that lead to certain desirable outcomes. Some emphasized practices that promoted long-term resource use and ensured rights of future generations. Some stressed intensive agriculture while others emphasized integrated farming systems as key to sustainable agriculture. Hence sustainable agriculture was perceived by the respondents as a set of practices that ensure intergenerational equity and at the same time enable intensive exploitation of arable land while integrating the forms, dynamics and functions of all constituents within the agroecosystem. Second, non-damaging or non-disruptive *environmental effects* were considered as definitive features of sustainable agriculture. Third, the perspective that sustainable agriculture incorporates a dialogue between ecological and economic priorities underscored the theme of *human goals* (such as meeting the socio-economic needs of a community). Since ideas of environmental protection and the meeting of human goals were central to the administrative officials' perspectives, support for sustainable agriculture among institutional personnel is likely to have two distinct driving forces -- environmental concerns and human welfare. Given that other factors are favourable, this mindset can create fertile ground for sufficient support among institutional personnel in successfully implementing policies that equilibrate both human and ecological goals. It is possible that one-sided policies will receive much less patronage. Fourth, respondents highlighted that a lack of policy support is not conducive for sustainable agriculture outcomes. There was a view among some respondents that the existing agricultural policy framework in Sri Lanka is not geared to promoting sustainable agriculture. The persistence of sustainable agriculture in the form of more traditional farming practices was credited largely to farmers' efforts. This non-committal stance towards traditional forms of agriculture in various parts of the developing world, has also been reported by writers such as Altieri (2002), Pretty (1995) and Rosset (2000), and also appears to be a constraining factor for sustainable agriculture outcomes in Sri Lanka. Institutions reinforce legitimacy by agenda setting which involves both *decision making* and *non-decision making* that serves to maintain the status quo and the authority that institutional structures have over socio-economic structures that they govern (Adger, 2000). In the situation of Sri Lanka *non-decision making* whether purposive or otherwise, in formulating policies to promote traditional forms of agriculture, appears to offer little validity to these farming practices which farmers favour due to their ecological and socio-economic advantages.

Therefore, the prevailing belief among institutional personnel is that the impasse to sustainable agriculture outcomes is an unsupportive policy framework that favours a technology based, profit-oriented, agribusiness model. Clearly such a model is incapable of adequately addressing environmental and human needs. Yet the adoption of alternatives appears to be severely impeded by political-corporate power and vested interests. Although Rosset (2000) points out that psychological barriers to believing that an alternative model can work is similarly difficult to surmount, the findings of this study revealed that this was not the prevalent mindset among institutional personnel at least occupying the district, divisional and village level hierarchies of the institutional structure in Sri Lanka's agriculture sector.

Extension services also play a significant role in reinforcing what is legitimate and what is not. Farmer training and extension appeared to be viewed as important institutional responsibilities by the respondents. At the same time most respondents perceived traditional farming systems as a valuable reservoir of knowledge and recognized the possible contribution of farmers' knowledge and experience to technology generation. There is general consensus among institutional personnel that traditional farming systems are appropriate models for achieving environmentally sound and socially responsive agricultural outcomes especially for marginalized farming communities, indicating a shift from a market oriented thinking (which is characteristic of the existing agriculture policy framework), to a more holistic ideology. Hence 'prescribed practices' (through extension services) and 'adaptive processes' (through farmers' innovations) are viewed as being complimentary rather than being contradictory. Likewise, most respondents favoured farmers' participation in research and experimentation; this denotes a prevailing attitude that agricultural development should not be based purely on objective approaches and technical solutions. People and their behaviours are seen as important elements in farming systems research to allow for multiple interpretations of *truth* and to establish credibility, which invariably leads to neutralizing knowledge-power relationships (Robinson *et al.*, 2001). The respondents' attitude therefore, indicate an openness towards power-sharing and dialogue between research personnel and farmers. Equitable power-sharing also includes enabling communities to exercise greater control over decisions that affect them in the arena of resource management (Holdgate, 1997). The vast majority of the respondents acknowledged that it is beneficial to work with community groups in managing resources, pointing out that community backed projects produced satisfactory results in accomplishing resource management objectives. It appears that a highly supportive disposition towards community consultation and empowerment exists

within the current institutional structure of Sri Lanka's agriculture sector. However, to determine the extent to which it is put into practice is not within the scope of this study. Further research is recommended in that area.

Another important observation that research findings are delayed in reaching the farmers undeniably indicates a hiatus in the links between research and extension. As a means to correct this weakness, participatory research is seen as a solution to providing farmers more timely feedback as it engages field experiments where farmers are involved in all stages of the research. Hence, the information and the knowledge they require for decision making becomes directly and more promptly available to them.

In order to understand how respondents view agroecological production systems, I explored their views on some basic principles common to the two agroecological farming systems concerning this study. The subsequent section enlists some conclusions pertinent to their views on some agroecosystem principles that subsistence farmers rely on to increase productivity in the long-term. One of the prominent themes cross-cutting most of the principles examined is a reference to *tradition*.

- There was high level of consensus that recycling of organic matter is a sustainable practice leading to enhanced soil fertility and biodiversity. Closed nutrient cycles are endorsed as a widely accepted practice, suggesting that the level of social acceptance is also influential in deciding the significance of certain agricultural practices, possibly due to their success as 'tried and tested' methods. This phenomenon also reinforces the idea that 'adoption is a socio-cultural process' (Vanclay, 2004, 214).
- With regard to soil conservation the dominant theme was the need to update outmoded practices in soil conservation to counter the current trends in resource degradation that have resulted from increased pressures on the natural resource base. Although traditional systems were seen as models for resource-conserving technologies there seems to be a consensus that soil conservation is an area where further innovations and evolutionary changes are required.
- In general, reliance on local inputs and knowledge was perceived as being a sustainable practice as well as being suitable to local conditions. However, total elimination of external inputs was not considered possible. Although local knowledge was recognized as applicable in a number of ways it was viewed that modern

technology adapted to suit local conditions is effective and useful in certain situations, which correspond to the observations noted in the previous discussion regarding the convergence of top-down technology transfer and farmers knowledge. A need to ensure the continuity of local / traditional knowledge systems is recognized and since farmers are the keepers of most of this traditional wisdom facilitation of knowledge sharing among farmers was seen as being expedient.

- With regard to rainwater harvesting a frequent theme that emerged was the concern regarding water shortages during the dry season, or during periods of disrupted rainfall. As practised traditionally, rainwater harvesting was seen as a partial solution to an otherwise disastrous dry spell. A need for small-scale water harvesting at the household level was frequently emphasized.
- Plant and animal synergies within integrated farming systems were viewed as contributing to mutual benefits among agroecosystem components enhancing the robustness of a farming system. Likewise, socio-economic benefits are also acknowledged as end results of an integrated system.
- There was agreement among the respondents that agro-biodiversity is a common feature in traditional farming systems. However it was also noted that modern monocultural farming practices are contributing to the loss of many traditional varieties. There is also the view that there are no policy measures taken to arrest such decline in traditional crops varieties. This observation invariably suggests that policy guidelines need to be instated if irrevocable losses of genetic resources are to be averted.

Against this backdrop of ideas regarding agroecological production systems, I further explored two types of agroecological farming systems specific to Sri Lanka, namely chena cultivation and Kandyan homegardens. First I looked to administrative officials and their perceptions of aspects relating to chena cultivation.

Administrative officials' attitudes towards chena cultivation in general ranged from ideas of approval to mixed impressions of its environmental soundness. A considerable number of the respondents perceived chena cultivation as a sustainable form of farming with the condition that sufficiently long fallow periods are applied. *Tradition* emerged as a prominent theme here. While it was recognized that chena cultivation, when carried out with traditional management practices was a sustainable mode of farming, there was the general notion that chena cultivation, as was traditionally practised is no longer viable due to current resource

constraints. Some respondents also stated that chena farming can be a self-sustaining system with little need for input.

There is also a strongly held notion that the problem of chena cultivation lies in its shifting nature, which needs ‘stabilization’. The issue of resource constraints appears to be a dominant theme here, and enforcing a sedentary farming system is seen as a solution to the mounting pressure on the natural resource base. There are inherent contradictions to stabilizing chena cultivation. As Vitebsky (1984) points out, while attempting to *decrease* resource degradation ‘stabilized chena farms’¹ also aim to *increase* productivity – two goals which eventually pull in opposite directions. Some respondents expressed a certain amount of doubt as to whether these goals can be successfully achieved through stabilization. Hence there appears to be an uneasy alliance between ideas of ‘shifting’ cultivation as it is traditionally practised and impetus to ‘stabilize’ such systems. Therefore the concept of stabilized chena cultivation appears to be open to debate and the lack of alternative solutions seems to have created a stalemate situation. Although agricultural policy lends much support for promoting ‘stabilized highland farming’ in place of chena cultivation the analytic literature is less optimistic regarding its merits. In seeking for alternatives a purely a technical approach may not be sufficient. What is urgently required is a better understanding of the underlying social, political, and economic factors that contribute to poor land management among present day chena cultivators. Further research is recommended in this area.

Another rift in attitudes between respondents was revealed on the subject of resource conservation in chena cultivation. While a considerable number of respondents claimed that chena cultivation conserved soil, water and biodiversity a similar portion of respondents disagreed on this point. It is possible that both observations may be quite valid. The two types of farmers who most often rely on chena cultivation are the traditional farmers and migrant farmers and they vastly differ in their practices (*New Agriculturalist*, 1999). While the former has intimate knowledge of the environment and adopts necessary management practices the latter does not. Therefore the results differ, which inevitably validates both viewpoints presented by the respondents. From a policy perspective it may be necessary to accurately determine how and why the two groups and their practices differ, as such insights will be useful for more informed policy formulation related to chena cultivation.

¹ Stabilized chena cultivation is more commonly referred to as stabilized highland farming.

Respondents' ideas on the adaptive attributes of chena cultivation revealed that a considerable number viewed chena cultivation as being well adapted to environmental constraints such as pests and marginal lands / soils. However, there were also views to the contrary. Tradition and its benefits were frequently intertwined with the respondents' observations, indicating a prevalent view that traditional practices are geared towards ecological adaptation and therefore must remain part and parcel of the chena cultivation system.

On the subject of food security, the majority of respondents perceived chena cultivation as ensuring food security to subsistence farmers throughout the year. A dominant theme that emerged was the function of the chena as a 'virtual food storage'. This function was attributed to the diversified cropping patterns within the chena that yielded some form of harvestable crops throughout the year. Most respondents also emphasized the importance of stored crops as well as growing cash crops in the chena as measures to buffer economically difficult periods. Overall, chena cultivation is viewed as a socio-economic necessity for subsistence farmers.

Most respondents perceived Kandyan homegardens as an environmentally sustainable farming system. Attributes related to soil conservation, minimization of soil erosion, mimicking of a natural forest and species diversity were highlighted as key sustainability features within the system. As such Kandyan homegardens were seen to provide significant biological and ecological functions such as being the sanctum for rapidly diminishing fauna and flora, watershed protection and nutrient cycling. Likewise, a considerable number of the respondents claimed that Kandyan homegardens are well adapted to environmental constraints such as pests and marginal lands / soils. Also more optimistically, there were those who perceived Kandyan homegardens as having the potential to restore degraded land.

On the subject of food security there appears to be mixed feelings among institutional personnel regarding the emphasis on growing cash crops in Kandyan homegardens. A significant number of the administrative officials agreed that Kandyan homegardens ensured food security to subsistence farmers. Crop variety was frequently perceived as a determinant of food security because it can provide food for consumption as well as a cash income that could ensure food accessibility to the farmer. However, there were also opinions to the contrary that the Kandyan homegardens do not ensure food security as they tend to concentrate too much on cash crops. It is clear that situations where food crops compete with

cash crops and where a farmer cannot allocate enough resources to grow sufficient food crops, is seen as disadvantageous in terms of food security by some respondents. This perception differs from others held by those who see cash crops as ensuring the farmer with a cash income, thereby providing the farmers accessibility to purchasable food items. The incongruity of ideas pertaining to the role of cash crops could be due to different understandings of the concept of food security among the respondents. In addition, a considerable portion of the respondents hold the view that the Kandyan homegardens are a potential economic safety net for resource poor farmers during economically difficult times.

The discomfiture regarding Kandyan homegardens that are engineered under the auspices of agribusiness among officials is justifiable when looking back at the history of the mono-crop based estate sector which benefited the mercantile class creating 'islands of privilege and prosperity in a sea of peasant poverty' (McConnell, 2003, 130) due to disinterest in food production or the welfare of the rural poor. 'Cash crops' as the term implies is solely 'cash' driven. It may be necessary to keep in mind that history has a habit of repeating itself. The agribusiness model, therefore, may not be the best approach. However, agriculture policy actively promotes this model. It is imperative that these developments are closely monitored to ensure that they do not, at some point slip into the same mould as the estate sector.

Overall, both the chena and Kandyan homegardens are perceived as having features that are environmentally and socio-economically significant. Kandyan homegardens are readily acknowledged for their ecological advantages while chena cultivation is perceived as being somewhat more controversial in terms of its environmental impacts. Yet, the underlying factors of chena cultivation appears to be complex and what is required from a policy perspective is a better understanding of various land use practices and their ecological reverberations.

Finally, I inquired into the existing policy environment to garner an understanding of policy and institutional influences pertaining to chena cultivation and the Kandyan homegardens. There were diverse ideas and opinions expressed in this area. A majority supported the idea of promoting traditional farming systems, emphasizing a number of reasons that warrant their continuation. In general, traditional farming systems were perceived as having safety and security features such the capacity to eliminate health risks posed by agro-chemicals, preserve crop varieties, provide food security / accessibility and proffer a form of crop insurance for

subsistence farmers. However, the need to adopt these systems with improvements, modifications or innovations to suit present day conditions was frequently emphasized. This idea was echoed by one agricultural professional who articulated that there is a need to recognize the valid essence of traditional farming practices while being guided by modern scientific knowledge. Yet, the existing policy directive is to transform subsistence agriculture into high-income technology based agro-business enterprises (MENR, 2002). It is clearly indicative that the prevailing perceptions within the institutional structure is not synchronous with the purely economically driven policy objective of transforming subsistence agriculture into profit oriented, technology based agro-businesses. The current policy appears to be a politically inspired technocratic approach to subsistence agriculture without sufficient grounding on actual needs and circumstances of resource poor farmers whereas most administrative officials appear to hold views that are more sympathetic to social needs. It may be that district, division and village level officials have a better understanding of the social realities of farmers as they have more direct contact with them. As such their ideas may not always represent or reflect the ideology embedded in policies enplaced by a centralized authority. On the other hand those who were opposed to traditional practices stressed the need for alternatives but did not specify any alternatives. Poor land management practices were the main concern among these respondents who disapproved of traditional practices in favour of farming practices based on modern technology. However, a mere physical and technical solution may not be the answer to this problem as it is usually a combination of economic, social and political factors that determine land use practices (Redclift, 1990). Therefore what is required from an institutional perspective is to understand *why* undesirable land use practices are carried out by farmers, as it may not be possible to propose alternatives without understanding the underlying causes of poor land management practices.

It has been pointed out that the prime focus of Sri Lanka's agricultural policy is irrigated agriculture and, therefore, rainfed systems such as chena cultivation are sidetracked and given little attention by the authorities. Agriculture policy puts more weight on promoting modern technologies. As such the more affluent farmers benefit from modernized farming while resource poor farmers face further marginalisation. Furthermore, such bureaucratic bias and a lack of interest in traditional systems is further compounded by the lack of support for subsistence farmers from extension services that have taken the form of district level model farms which offer little extension support to traditional agriculture. A paucity of research and development efforts for improving traditional systems is seen as another setback.

It also became evident that certain agricultural policies were seen as supportive of traditional farming practices. The policy for promotion of organic agriculture was seen as a supportive ingredient within the existing policy environment. NGOs were supportive taking on an active role in promoting traditional farming practices.

However, it is evident from the responses that agricultural policy does not offer direct support to chena cultivation and promotes stabilized highland farming instead. Stabilized highland farming is actively promoted through the extension services and in addition receive credit facilities and marketing support. Hence there is a strong policy drive towards stabilization of shifting cultivation. Yet, purely technical approaches to stabilizing shifting cultivation have not been highly successful in many situations (Cairns and Garrity, 1999). What is required may not be a purely technocratic approach but a participatory, on-farm, demand-driven research approach for generating alternatives. Although chena cultivation has never received any direct policy support, there seems to be a great deal of empathy from administrators towards the plight of subsistence farmers. In fact, the silent permissiveness of the authorities towards chena cultivation is itself a form of support. In contrast to the somewhat indifferent attitude towards traditional forms of chena cultivation, Kandyan homegardens on the other hand, have received a considerable level of acceptance and policy support. For example, government policies for developing export crops sector, as well as poverty reduction schemes lend much support to the Kandyan homegardens.

In the final analysis, a successful hybrid between the two systems of knowledge leading to an agricultural paradigm that is suited to present day needs may be the most appropriate solution to the challenges facing the Sri Lankan agriculture sector. The perspectives, perceptions and opinions of those in formal institutional settings there will be important in helping to forge this change in direction. In this vein, findings from my work will have implications for policy formulation and implementation for natural resource managers as they attempt to garner an understanding of the underlying value systems and tacit beliefs of those within the institutional structure. In addition, my work will contribute to an understanding on institutional and policy dynamics at play within the complex ecological and social terrain of resource poor farmers in Sri Lanka.

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School of Geography and Environmental Studies

University of Tasmania

Questionnaire

Please answer using the key below and tick the appropriate box. After providing your answer please explain the reasons for your answer briefly in the spaces provided.

SA = Strongly Agree

A = Agree

N = Neutral

D = Disagree

SD = Strongly Disagree

DN = Do Not Know

SECTION 1: Environmental and Social Aspects of Chena and Kandyan Garden System

1. *When it is carried out with sufficient intervals in between vegetation clearing, the chena cultivation method is an environmentally sustainable farming practice.*

SA ☐ A ☐ N ☐ D ☐ SD ☐ DN ☐

Please explain your answer:

2. *In order to minimize forest clearing the chena cultivation method should be transformed from shifting cultivation into a more stabilized form of highland farming.*

SA ☐ A ☐ N ☐ D ☐ SD ☐ DN ☐

Please explain your answer:

3. *The Kandyan home garden system is an environmentally sustainable farming practice.*

SA ☐ A ☐ N ☐ D ☐ SD ☐ DN ☐

Please explain your answer:

4. *The chena cultivation method conserves local resources such as:*

- | | | | | | | | | | | | | |
|-------------------------|----|--------------------------|---|--------------------------|---|--------------------------|---|--------------------------|----|--------------------------|----|--------------------------|
| (a) <i>Soil</i> | SA | <input type="checkbox"/> | A | <input type="checkbox"/> | N | <input type="checkbox"/> | D | <input type="checkbox"/> | SD | <input type="checkbox"/> | DN | <input type="checkbox"/> |
| (b) <i>Water</i> | SA | <input type="checkbox"/> | A | <input type="checkbox"/> | N | <input type="checkbox"/> | D | <input type="checkbox"/> | SD | <input type="checkbox"/> | DN | <input type="checkbox"/> |
| (c) <i>Biodiversity</i> | SA | <input type="checkbox"/> | A | <input type="checkbox"/> | N | <input type="checkbox"/> | D | <input type="checkbox"/> | SD | <input type="checkbox"/> | DN | <input type="checkbox"/> |

Please explain your answer to 4 (a):

Please explain your answer to 4 (b):

Please explain your answer to 4 (c):

5. *The Kandyan home garden system conserves local resources such as:*

- | | | | | | | | | | | | | |
|-------------------------|----|--------------------------|---|--------------------------|---|--------------------------|---|--------------------------|----|--------------------------|----|--------------------------|
| (a) <i>Soil</i> | SA | <input type="checkbox"/> | A | <input type="checkbox"/> | N | <input type="checkbox"/> | D | <input type="checkbox"/> | SD | <input type="checkbox"/> | DN | <input type="checkbox"/> |
| (b) <i>Water</i> | SA | <input type="checkbox"/> | A | <input type="checkbox"/> | N | <input type="checkbox"/> | D | <input type="checkbox"/> | SD | <input type="checkbox"/> | DN | <input type="checkbox"/> |
| (c) <i>Biodiversity</i> | SA | <input type="checkbox"/> | A | <input type="checkbox"/> | N | <input type="checkbox"/> | D | <input type="checkbox"/> | SD | <input type="checkbox"/> | DN | <input type="checkbox"/> |

Please explain your answer to 5 (a):

Please explain your answer to 5 (b):

Please explain your answer to 5 (c):

6. *The chena cultivation method is well adapted to environmental constraints such as:*

- | | | | | | | | | | | | | |
|---------------------------|----|--------------------------|---|--------------------------|---|--------------------------|---|--------------------------|----|--------------------------|----|--------------------------|
| (a) <i>Marginal lands</i> | SA | <input type="checkbox"/> | A | <input type="checkbox"/> | N | <input type="checkbox"/> | D | <input type="checkbox"/> | SD | <input type="checkbox"/> | DN | <input type="checkbox"/> |
| (b) <i>Marginal soils</i> | SA | <input type="checkbox"/> | A | <input type="checkbox"/> | N | <input type="checkbox"/> | D | <input type="checkbox"/> | SD | <input type="checkbox"/> | DN | <input type="checkbox"/> |

(c) *Pests*

SA ☐

A ☐

N ☐

D ☐

SD ☐

DN ☐

Please explain your answer to 6 (a):

Please explain your answer to 6 (b):

Please explain your answer to 6 (c):

7. *The Kandyan home garden system is well adapted to environmental constraints such as:*

(a) *Marginal lands*

SA ☐

A ☐

N ☐

D ☐

SD ☐

DN ☐

(b) *Marginal soils*

SA ☐

A ☐

N ☐

D ☐

SD ☐

DN ☐

(c) *Pests*

SA ☐

A ☐

N ☐

D ☐

SD ☐

DN ☐

Please explain your answer to 7 (a):

Please explain your answer to 7 (b):

Please explain your answer to 7 (c):

8. *The chena cultivation method ensures year round food security for resource poor farmers.*

SA ☐

A ☐

N ☐

D ☐

SD ☐

DN ☐

Please explain your answer:

9. *The Kandyan home garden system ensures year round food security for resource poor farmers.*

SA ☐ A ☐ N ☐ D ☐ SD ☐ DN ☐

Please explain your answer:

10. *The chena cultivation method helps the subsistence of resource poor farmers during periods of economic uncertainty.*

A ☐ A ☐ N ☐ D ☐ SD ☐ DN ☐

Please explain your answer:

11. *The Kandyan home garden system helps the subsistence of resource poor farmers during periods of economic uncertainty.*

SA ☐ A ☐ N ☐ D ☐ SD ☐ DN ☐

Please explain your answer:

SECTION 2: Agroecosystem Principles / Processes

*The following principles/processes (in questions 12-19) are **important** for maintaining agroecosystem sustainability:*

12. *Recycling of biomass.*

SA ☐ A ☐ N ☐ D ☐ SD ☐ DN ☐

Please explain your answer:

13. *Soil conservation techniques.*

SA ☐ A ☐ N ☐ D ☐ SD ☐ DN ☐

Please explain your answer:

14. *Independence from external inputs -- in other words, making use of local knowledge, resources and inputs.*

SA A N D SD DN

Please explain your answer:

15. *Harvesting of rainwater.*

SA A N D SD DN

Please explain your answer:

16. *Integration of crop and livestock.*

SA A N D SD DN

Please explain your answer:

17. *Species and genetic diversification of the agroecosystem in time and space.*

SA A N D SD DN

Please explain your answer:

18. *Enhancement of beneficial biological interactions and synergisms among agro biodiversity components.*

SA A N D SD DN

Please explain your answer:

19. Selection of cropping patterns to match the landscape and climate.

SA A N D SD DN

Please explain your answer:

20. If you answered ‘Strongly Agree’ or ‘Agree’ to any of the questions from 12-19 please rank their level of importance in the spaces below on a scale of 1-5, where 1 is **highly** important to 5 is **slightly** important.

<u>Ranking</u>	<u>Principle / Process</u>
.....	Recycling of biomass
.....	Soil conservation techniques
.....	Independence from external inputs –reliance on local knowledge and resources
.....	Harvesting of rainwater
.....	Integration of crop and livestock
.....	Species and genetic diversification of agroecosystem in time and space
.....	Enhancement of beneficial biological interactions and synergisms in the agroecosystem
.....	Selection of cropping patterns to match the landscape and climate

SECTION 3: Sustainable Agriculture

21. Please define sustainable agriculture in your own words:

22. Sustainable agriculture needs to be promoted as a prescribed package of measures for use by farmers.

SA ☐ A ☐ N ☐ D ☐ SD ☐ DN ☐

Please explain your answer:

23. Sustainable agriculture needs to be considered as a process with opportunities to learn and adapt.

SA ☐ A ☐ N ☐ D ☐ SD ☐ DN ☐

Please explain your answer:

24. Much can be learnt from traditional farming practices.

SA ☐ A ☐ N ☐ D ☐ SD ☐ DN ☐

Please explain your answer:

25. Modern agriculture is the only answer to food security.

SA ☐ A ☐ N ☐ D ☐ SD ☐ DN ☐

Please explain your answer:

26. In resource management, it is beneficial to work with local groups and community organizations.

SA ☐ A ☐ N ☐ D ☐ SD ☐ DN ☐

Please explain your answer:

27. *Farmers' participation in research and experimentation should be encouraged.*

SA ☐ A ☐ N ☐ D ☐ SD ☐ DN ☐

Please explain your answer:

SECTION 4: Agricultural Policy

For the following questions (28 – 31) please answer in your own words in the spaces provided below. If you require extra space please attach additional paper and number each response from 28-31.

28. (a) *Do you think resource poor farmers should be encouraged to adopt traditional farming systems such as chena cultivation and the Kandyan home garden system?*

☐ Yes ☐ No ☐ Undecided

(b) *Please give reasons to explain your answer*

29. (a) *In your opinion, what elements in agriculture policy support traditional farming systems such as chena cultivation and the Kandyan home garden system?*

(b) *How are they supportive to traditional farming systems?*

30. (a) *What elements in agriculture policy would you identify as constraints to traditional farming systems such as chena cultivation and the Kandyan home garden system?*

(b) *How do they constrain traditional farming systems?*

31. *Are there any other additional comments that you would like to make regarding chena cultivation and the Kandyan home garden system?*



School of Geography and Environmental Studies
University of Tasmania

Questionnaire

Please provide answers to the following questions on separate paper and number each response from 1-9. You may make them as detailed as you like.

Question #1

If there are any, what are the environmental advantages and disadvantages of chena cultivation and why do you consider them to be environmentally advantageous or disadvantageous?

Question #2

If there are any, what are socio-economic benefits or drawbacks of chena cultivation and why do you consider them to be benefits or draw-backs in a socio-economic sense?

Question #3

If there are any, what are the environmental advantages and disadvantages of the Kandyan home garden system and why do you consider them to be environmentally advantageous or disadvantageous?

Question #4

If there are any, what are socio-economic benefits or drawbacks of the Kandyan home garden system and why do you consider them to be benefits or draw-backs in a socio-economic sense?

Question # 5

- (a) Should the chena cultivation method be transformed to assist resource poor farmers?
- (b) If so, how? Please give reasons to explain your answer.

Question # 6

- (a) Should resource poor farmers be encouraged to adopt traditional farming systems such as chena cultivation and the Kandyan home garden system?
- (b) Please give reasons to explain your answer

Question # 7

- (a) What elements in agriculture policy support traditional farming systems such as chena cultivation and the Kandyan home garden system?
- (b) How are they supportive to traditional farming systems?

Question # 8

- (a) What elements in agriculture policy constrain traditional farming systems such as chena cultivation and the Kandyan home garden system?
- (b) How do they constrain traditional farming systems?

Question # 9

Are there any other additional comments that you would like to make regarding the chena cultivation method and the Kandyan home garden system?

[Date]

[Address Fields]

Dear [Name of Participant],

Information Sheet
Institutional Aspects Relating to Agroecological Farming Systems in Sri Lanka

You have been identified as having expert knowledge on agricultural policy and institutional arrangements at the [national / district / village] level and as currently serving in the public sector by [Name of the head of the Institution]. We would like to invite your participation in a research project that will explore institutional aspects relating to agricultural practices in Sri Lanka, as part of a study for the partial fulfilment of a Master of Environmental Management degree being undertaken by the investigator, Hasanthi Tennakoon at the University of Tasmania, Australia.

The study will focus on farming systems which have evolved over the years based on socio-economic needs and environmental circumstances of resource poor farmers. The aim of the study is to explore institutional policy and practices at various levels of the government that may influence these agroecological farming systems. Findings of this study may be significant in terms of policy formulation and planning in natural resource management as it attempts to gain an understanding of the institutional dynamics at play within the complex ecological and social terrain of farmers in Sri Lanka.

Given this background, we would like to request your participation in filling out a questionnaire which will be sent to you shortly [through email / by mail]. The questionnaire may take 20-30 minutes to complete. Questions cover topics such as:

- Environmental sustainability of *chena* cultivation / the Kandyan garden system
- Socio-economic significance of *chena* cultivation / the Kandyan garden system
- Sustainable agriculture
- Traditional farming systems
- Agricultural policies and practices relating to food security
- Policies that constrain or support agroecological farming practices
- Farmers' influence on agricultural policy and planning

Once we receive your responses the answered questionnaires will be de-identified to protect any confidences that may have emerged in your replies. De-identification will ensure that your responses remain anonymous. The list of respondents will not in any way be linked the actual questionnaires and will only be kept for the purpose of providing respondents with a summary report. These will be kept in locked storage at the School of Geography and Environmental Studies, as data must be kept for a minimum period of five years, after which it will be destroyed.

Your participation is entirely voluntary, and your consent to participate is evidenced by returning the completed questionnaire.

This project has received ethical approval from the Human Research Ethics Committee (Tasmania) Network (HREC). Inquiries of a general nature about the project may be directed to the chief investigator Elaine Stratford (on 61-3-62262462 or Elaine.Stratford@utas.edu.au) If you have any other concerns or complaints about any aspects of the project or its conduct, please contact the Executive Officer of the

HREC (Amanda McAully, on 61-3-6226 2763 or Amanda.McAully@utas.edu.au). She can direct you to the relevant committee Chair who initially reviewed the project proposal.

As the project draws to a conclusion in February 2005 we will provide all participants with a summary report of the findings of the study, which may provide potentially useful insights to your field of work.

Many thanks in anticipation of your participation.

Yours sincerely,

Elaine Stratford
Chief Investigator

Hasanthi Tennakoon
Student Investigator

Examples of Plants Contained Within Each Strata of the Homegardens

Constituent Plant Species	Description / Uses
<u>Upper Layer (25 – 30 m)</u> <ul style="list-style-type: none"> ▪ Durien ▪ Talipot palm ▪ Jak ▪ Coconut palm ▪ Kapok 	<p><i>Durio zibethinus</i>, tall open canopy, cash crop</p> <p><i>Corypha umbraculifera</i>, leaves for thatching, handicrafts</p> <p><i>Artocarpus heterophyllus</i>, important subsistence food, timber, leaves for feeding livestock</p> <p><i>Coconus nucifera</i>, important subsistence food, timber, cash crop</p> <p><i>Ceiba pentandra</i>, fibre and oil seed crop, live support for pepper vines</p>
<u>Upper Middle Layer (15 –25 m)</u> <ul style="list-style-type: none"> ▪ Bamboo ▪ Areca palm ▪ Nutmeg ▪ Clove ▪ Rubber ▪ Wild breadfruit ▪ Kitul palm ▪ Mango 	<p>Several varieties for construction, household use and sale</p> <p><i>Areca catechu</i>, nuts for masticory / medicinal purposes and sale</p> <p><i>Myristica fragrans</i>, nuts and mace, mainly a cash crop</p> <p><i>Eugenia caryophyllata</i>, cash crop</p> <p>Usually old trees, some of them may be tapped, serves as shade for cacao and coffee trees.</p> <p><i>Artocarpus nobilis</i>, timber, these are usually forest remnants and not deliberately planted</p> <p><i>Caryota urens</i>, tapped for toddy, processed as sugar / honey</p> <p>Many varieties for household consumption and sale</p>
<u>Lower Middle Layer (10 –15 m)</u> <ul style="list-style-type: none"> ▪ Pepper ▪ Avocado ▪ Mangosteen ▪ Bread fruit ▪ Rambutan ▪ Citrus ▪ Papaya 	<p><i>Piper nigrum</i>, cash crop</p> <p>Several varieties for household consumption and sale</p> <p>For household consumption and cash crop</p> <p><i>Artocarpus incisa</i>, subsistence food and for sale</p> <p>For household consumption and cash crop</p> <p>For household consumption and cash crop</p> <p><i>Carica papaya</i>, for household consumption and cash crop, sometimes tapped for papain</p>
<u>Lower Layer (3-10 m)</u> <ul style="list-style-type: none"> ▪ Banana / Plantain ▪ Cacao ▪ Coffee ▪ Passionfruit ▪ Betel ▪ Vanilla 	<p>Many varieties for subsistence food and for sale</p> <p>Beans are sun dried and sold, low in quality</p> <p>Subsistence and cash crop, low in quality</p> <p>For mostly household consumption and sometimes for sale</p> <p>For household consumption and for sale</p> <p>Mostly for medicinal purposes and sometimes for sale</p>
<u>Ground Level</u> <ul style="list-style-type: none"> ▪ Tea ▪ Cassava ▪ Ginger ▪ Turmeric 	<p>Cash crop</p> <p>For household consumption</p> <p>Mainly a cash crop, needs medium shade</p> <p>Mainly a cash crop, needs medium shade</p>

<ul style="list-style-type: none"> ▪ Anthurium ▪ Pineapple ▪ Chili Peppers ▪ Vegetables ▪ Yams ▪ Grass / fodder 	<p>Sometimes for sale</p> <p>Mainly for household consumption and sometimes for sale, thrives under excessive shade</p> <p>Major vegetable, condiment and cash crop</p> <p>Okra, eggplant, beans, etc. mainly for household consumption</p> <p>For household consumption and for sale, shade tolerant crop</p> <p>For stall fed goats and cattle</p>
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Source: McConnell, 2003